WATER WORKS & SEWERAGE

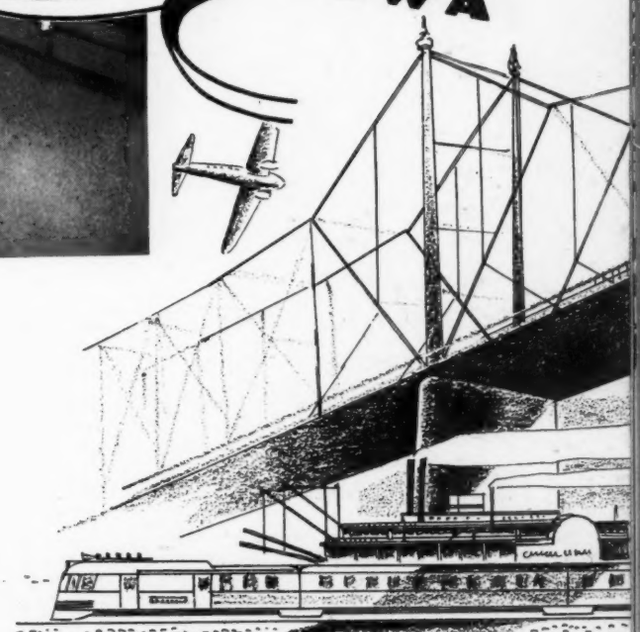
A GILLETTE PUBLICATION

EDITOR

JULY, 1937
VOLUME 84, No. 7

AERO-GRAPHIC CORP. PHOTO

IN BURLINGTON IOWA



Burlington, an industrial and wholesale distributing center, is located on the Mississippi in the center of the great Mid-West corn belt. The business district of Burlington is surrounded by beautifully wooded hills, dotted with homes, churches and schools.

The necessity and acceptance of the available four-fold transportation facilities, water, rail, air and highways, is evidenced by the many diversified industries located in Burlington.

One of the largest soap companies in the middle west, numerous woodworking plants, and an office furniture and equipment company are included in Burlington's industries. It is an important wholesale and jobbing as well as retailing city for the distribution of household furniture, groceries, hardware, plumbing supplies, drugs, industrial chemicals, baskets and caskets.

The water supply for the City of Burlington is obtained from the Mississippi River. Engines, built in Burlington, pump one billion gallons of thoroughly treated water annually, providing the 26,755 inhabitants of the city with an ample supply and assuring home owners and industries adequate fire protection. The metered consumers are assured accurate registration of consumption by the use of Pittsburgh Meters.

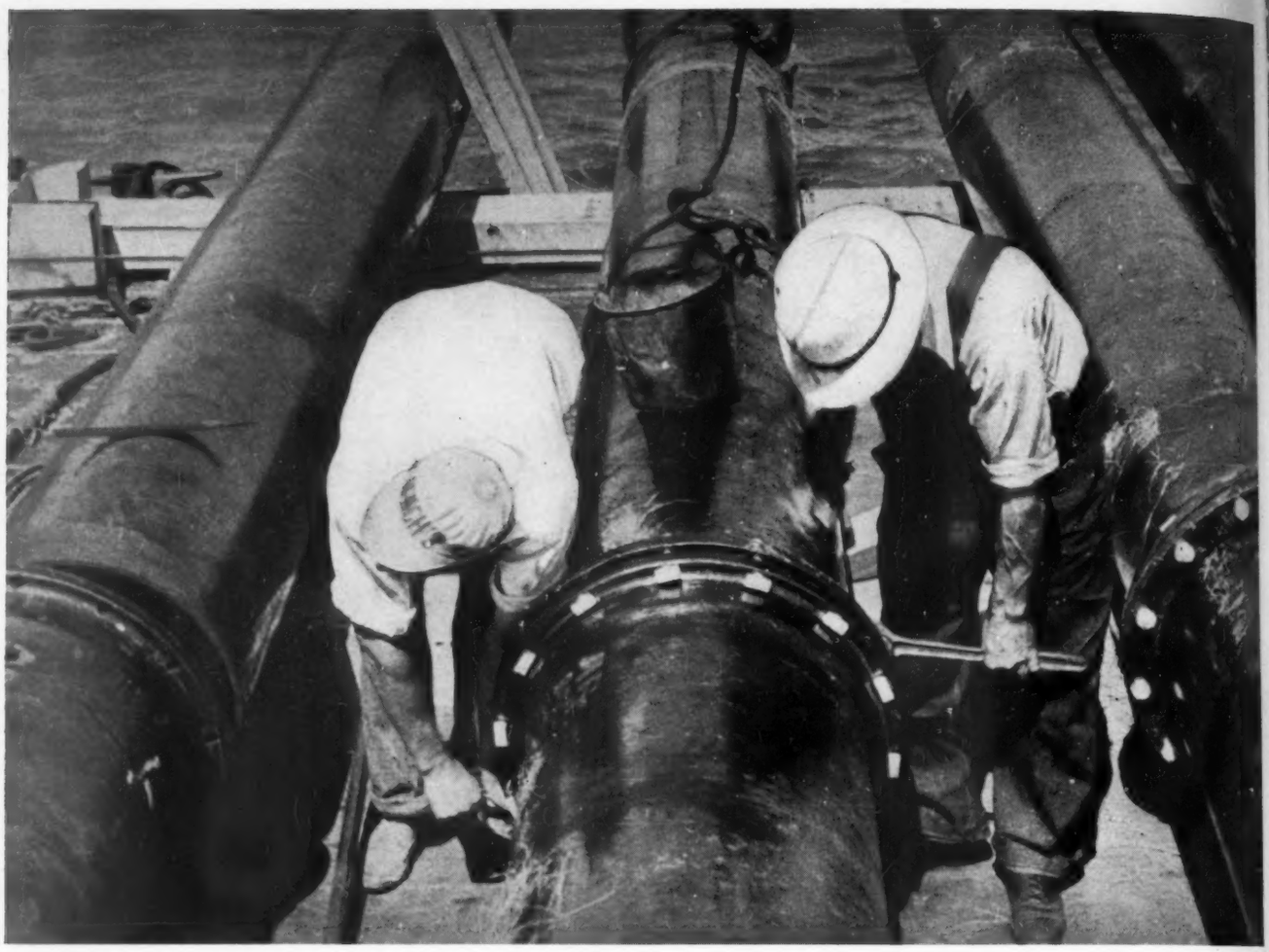
PITTSBURGH EQUITABLE METER CO.

MERCO NORDSTROM VALVE CO.

MAIN OFFICES PITTSBURGH, PA.

NEW YORK · LOS ANGELES · TULSA · HOUSTON · MEMPHIS · BUFFALO
COLUMBIA · KANSAS CITY · CHICAGO · PHILADELPHIA · ATLANTA · OAKLAND

PITTSBURGH WATER METERS



Installing 24" U. S. Joint Super-de Lavaud Pipe for outfall sewer at Cambridge, Md.

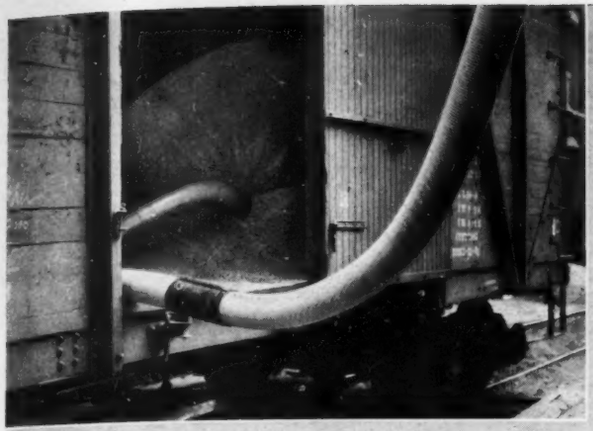
For outfalls, sanitary sewers and treatment plants, U. S. Cast Iron Pipe is available in diameters from 2" to 84" out of large stocks of pipe and fittings carried at 15 shipping points throughout the United States. The installation shown above is of U. S. Super-de Lavaud Cast Iron Pipe, cast centrifugally in a metal mold *without chill*, resulting in extraordinary impact strength. The U. S. Mechanical Joints used make a highly-deflectable, bottle-tight line. The combination of Super-de Lavaud Pipe and U. S. Mechanical Joints means a permanent, economical, and trouble-free outfall sewer.

UNITED STATES PIPE AND FOUNDRY COMPANY
BURLINGTON **NEW JERSEY**

Foundries and Sales Offices throughout the United States

U. S. CAST IRON PIPE

for sewers and sewage treatment plants



The Airveyor System offers a maximum of economy and convenience for unloading, conveying, and reclaiming from storage, lime, soda ash, bauxite, borax, alum, ferric sulphate, and other granular materials. One unit, with branch lines, will do all the work necessary in the average plant. There is nothing complicated about the installation and operation of this system. Equipment is available in a complete range of types and sizes to meet any requirement. You can determine in advance how much a system will save you. Each installation sold under a clean cut guarantee on capacity and power requirements.

FOR EFFICIENT ECONOMICAL CONVEYING

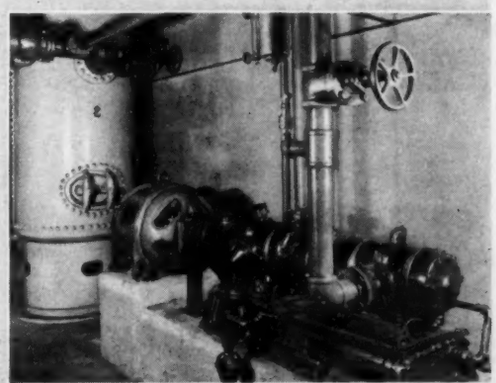
FULLER

FOR ECONOMICAL AIR COMPRESSION AND VACUUM

Fuller Rotary Compressors and Vacuum Pumps are being installed in many varied fields of industry. They are dependable, and their fewer moving parts, unique mechanical simplicity, and lack of vibration remove maintenance annoyances and costs. Original efficiencies are maintained after long periods of hard service. Many of these machines have established enviable records for continuous service without mechanical attention.

Compact dimensions and limited space requirements adapt Fuller Compressors and Vacuum Pumps for installation at the point of use.

Compressors and Vacuum Pumps, in single and two-stage, are available in full range of capacities up to 1800 c.f.m., actual delivery, working pressures up to 125 lb. gage, vacuums up to 99 percent of barometer.



FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

G-5

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS AUTOMATIC BATCH WEIGHERS BIN SIGNALS

WATER WORKS AND SEWERAGE, July, 1937, Volume 84, Number 7. Published monthly at 400 West Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1937. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

"Here Today" "Gone Tomorrow"

THOSE associated with travelling circuses have opportunity of judging the palatability of drinking water in the respective communities visited, but being temporary inhabitants must take "pot luck" in all supplies without being able to register any complaint.

Not so, however, with the permanent resident, who is vitally interested in the water supply and who frequently registers his voice when the tap water is not all that it should be.

Many judge the purity of their water by its taste. When tastes predominate, frequently people resort to the old pump, well, etc., without the benefit of sterilization — and usually the results are widespread epidemics.

AQUA NUCHAR does such an effective "job" of taste and odor removal at such a low per capita cost, that today little reason exists for tastes and odors breaking through to Mr. Consumer.

Make your plans now to attend the Annual Convention of the Southwest Section of the American Water Works Association to be held October 18-21, 1937, at the Hotel Driskill, Austin, Texas.

INDUSTRIAL *Chemical Sales*

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

NUCHAR

230 Park Ave.
New York, N. Y.

417 Schofield Bldg.
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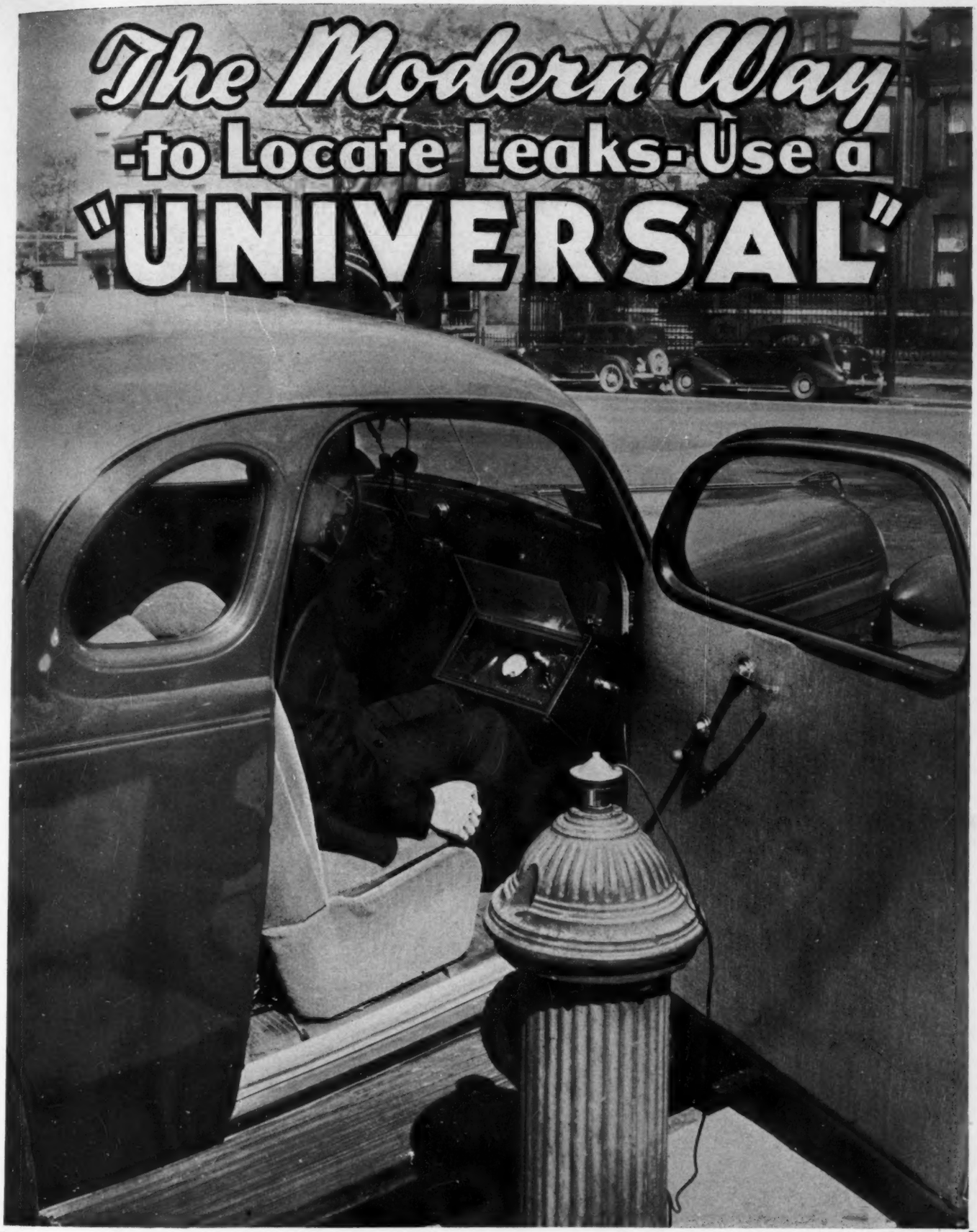
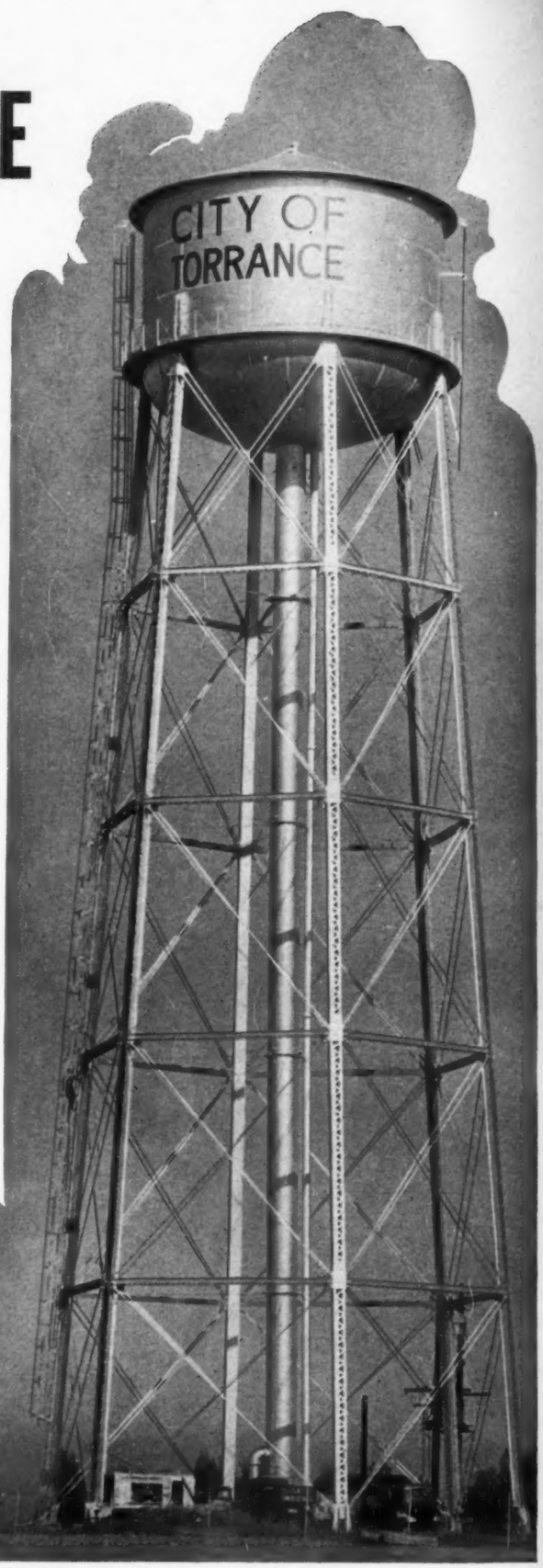
205 W. Wacker Drive
Chicago, Ill.



WRITE FOR OUR BOOKLET, "THE ANSWER TO YOUR WATER LEAK PROBLEMS."

WATER LEAK DETECTOR CO. 155 N. THIRD ST. COLUMBUS, OHIO

California city makes
ELEVATED STORAGE
the key to lower costs and better service



TORRANCE, CALIFORNIA, is another of the many towns throughout the country that have found out how easy it is to lower pumping costs and secure more uniform water pressure through elevated storage tanks of proper design and adequate capacity. The Horton ellipsoidal-bottom installation pictured at the right has 250,000-gal. capacity and is 140 ft. to bottom.

This tank was made the key to a water supply improvement program whereby basic costs were cut some 74 per cent and pressure fluctuations were reduced as much as 77 per cent. Instead of having to put up with pressures as low as 5 lbs. per sq. in., residents of Torrance now have uniformly high pressure at all times. Naturally, a great improvement in fire protection has also resulted.

It's easy to get exactly the results you want when you start with Horton Elevated Tanks. They are built in standard sizes from 5,000 to 2,000,000 gal. We will be glad to furnish complete information to readers interested in possible improvements for their own cities. We are also always glad to furnish quotations on all kinds of tanks, reservoirs, penstocks, large diameter steel pipe, smoke stacks, standpipes, and other types of welded or riveted plate work. Address our nearest office.

250,000 gallon Horton ellipsoidal-bottom tank located at Torrance, Calif.

CHICAGO BRIDGE & IRON COMPANY

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

Chicago.....2198 Old Colony Bldg.	Dallas.....1479 Liberty Bank Bldg.	Houston.....2919 Main St.	Boston.1548 Consolidated Gas Bldg.
New York.3390-165 Broadway Bldg.	Birmingham...1586 North 50th St.	Detroit.....1551 Lafayette Bldg.	San Francisco....1083 Rialto Bldg.
Cleveland....2262 Rockefeller Bldg.	Tulsa.....1646 Hunt Bldg.	Philadelphia..1644-1700 Walnut St.	Los Angeles...1455 Wm. Fox Bldg.

STOP
BELL AND SPIGOT
JOINT LEAKS

SKINNER-SEAL

MEANS INNER SEAL FOR LASTING REPAIR

● Coss-section shows exclusive Skinner method of SEALING rubber gasket under pressure. Direct! Positive! Lasting!

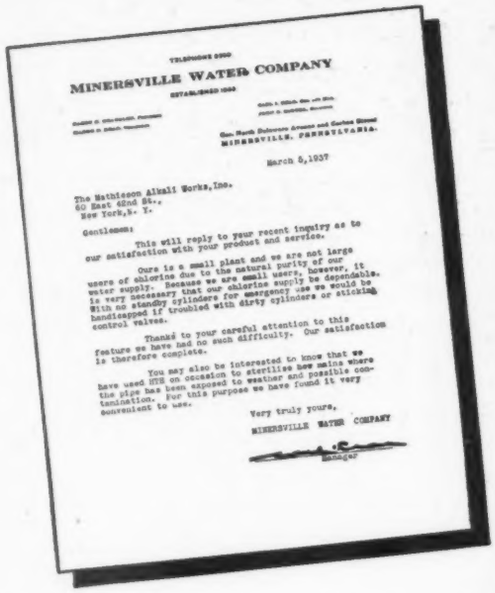
● Direct in action, SKINNER BELL JOINT CLAMPS make an instant, effective, lasting repair. Three unique features . . . gasket SEALED by Monel metal sheath band . . . self-adjusting to variations in pipe thickness . . . ¾" cadmium plated bolts. Sizes 3" to 48." WRITE TODAY FOR CATALOG.

M. B. SKINNER CO. *Est. 1898* **SOUTH BEND, IND.**

OVER 80 YEARS OF SERVICE

Since 1855, Minersville Water Co., has been giving good service to the Borough of Minersville, Pa. and vicinity.

This letter shows how Mathieson Chlorine and HTH have helped maintain this record.



MINERSVILLE WATER COMPANY

Geo. North Dalmouse Avenue and Garfield Street
MINERSVILLE, PENNSYLVANIA.

March 6,1937

The Mathieson Alkali Works,Inc.
60 East 42nd St.,
New York,N. Y.

Gentlemen:

This will reply to your recent inquiry as to our satisfaction with your product and service.

Ours is a small plant and we are not large users of chlorine due to the natural purity of our water supply. Because we are small users, however, it is very necessary that our chlorine supply be dependable. With no standby cylinders for emergency use we would be handicapped if troubled with dirty cylinders or sticking control valves.

Thanks to your careful attention to this feature we have had no such difficulty. Our satisfaction is therefore complete.

You may also be interested to know that we have used HTH on occasion to sterilize new mains where the pipe has been exposed to weather and possible contamination. For this purpose we have found it very convenient to use.

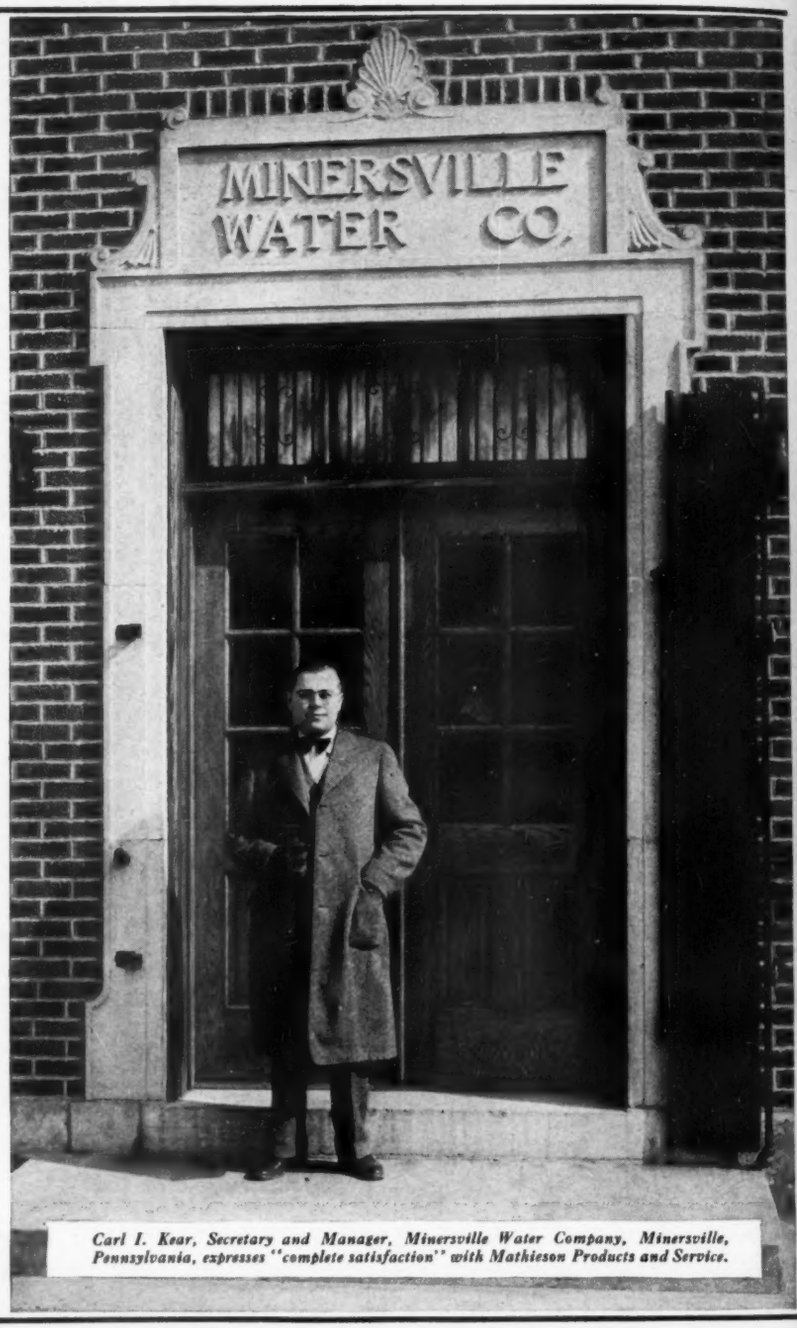
Very truly yours,
MINERSVILLE WATER COMPANY

Manager

FROM Carl I. Kear, whose letter is reproduced above, comes further evidence that water works men appreciate Mathieson quality and service.

As Mr. Kear says in his letter, "With no standby cylinders for emergency use we would be handicapped if troubled with dirty cylinders or sticking control valves. Thanks to your careful attention to this feature we have had no such difficulty. Our satisfaction is therefore complete."

To such a clear statement of satisfaction, there is little we can add—except that a thorough trial of Mathieson Chlorine and HTH will convince you of their dependability.



Carl I. Kear, Secretary and Manager, Minersville Water Company, Minersville, Pennsylvania, expresses "complete satisfaction" with Mathieson Products and Service.

MATHIESON CHLORINE···HTH

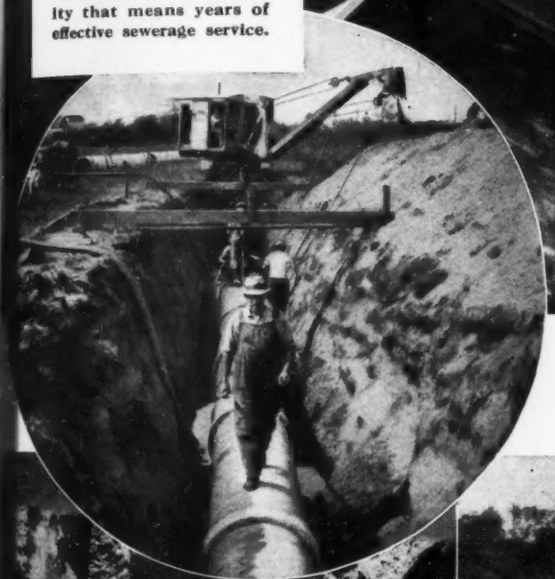
Mauufactured by

The MATHIESON ALKALI WORKS, (Inc.) 60 EAST 42nd STREET, NEW YORK, N. Y.

Already an important factor in efficient sewage disposal!

LIGHT IN WEIGHT... GREAT IN STRENGTH

Transite Sewer Pipe, by virtue of its light weight and great strength, provides for new transportation and handling economies. Assures the durability that means years of effective sewerage service.



TRANSITE SEWER PIPE... after accelerated laboratory tests and 3 years' field service... has proved that its many advantages assure lower installation, operating and maintenance costs

NEWLY ANNOUNCED in this country for sewage disposal, Transite Sewer Pipe carries into this field a quarter-century service record established by two virtually imperishable materials.

Asbestos and cement—molded under tremendous pressure into a dense, smooth-surfaced, homogeneous structure—form this modern sewer pipe. These two imperishable minerals give it a composition of great durability and unusual resistance to corrosion.

Moreover, Transite Sewer Pipe —for all its strength—is relatively light . . . exceptionally economical to transport and handle. And its long, standard 13-foot sections reduce the number of joints used. Thus, providing for further installation economies.

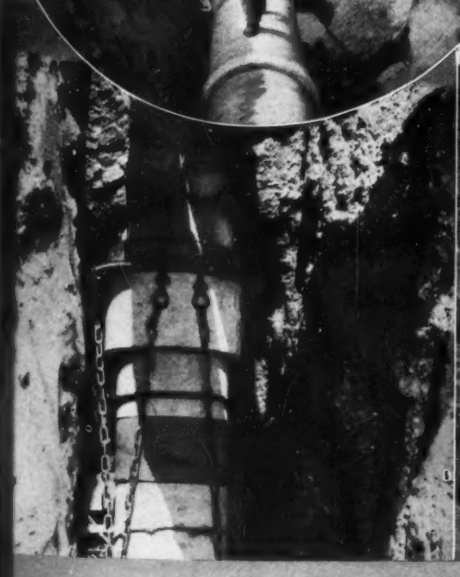
And on collecting systems, particularly, these long lengths make the installation of Transite Pipe to exact grades a quicker, cheaper and more accurate job.

Combines Every Advantage

Hence this modern sewer pipe combines in one material all the advantages demanded by effective sewerage service. In use on both collection and force mains, Transite Pipe has already taken its place as a highly important factor in the economical, efficient disposal of sewage.

Undoubtedly you'll want further information. Simply write Johns-Manville, 22 East 40th Street, New York City.

Johns-Manville
TRANSITE SEWER PIPE
An Asbestos Product



BOTTLE-TIGHT JOINTS on force mains are provided by the Simplex Couplings used on J-M Transite Sewer Pipe. Rapid assembly of these couplings is an important factor in making quicker, more economical work of all Transite Pipe installations.

RESISTANCE TO EXTERNAL AND INTERNAL CORROSION is assured by the asbestos-cement composition of Transite Sewer Pipe. All through its years of service, efficient sewage disposal will be maintained at minimum upkeep on the pipe line.

LONG, 13-FOOT LENGTHS are the standard lengths on Transite Sewer Pipe. On all collecting systems they make laying to exact grades a more accurate, quicker and cheaper job. On force mains, too, these long lengths reduce installation costs.

LIQUID CHLORINE

THAT OFFERS YOU THE ADVANTAGES OF HIGH PURITY

PERCHLORON
CHLORINE
AMMONIA
FERRIC CHLORIDE
FILTER ALUM

THE unusual care taken to safeguard the purity of the Chlorine produced by Pennsylvania Salt Manufacturing Company is the result of our keen appreciation of the many advantages that an extremely pure product offers to water purification and sewage disposal plants.

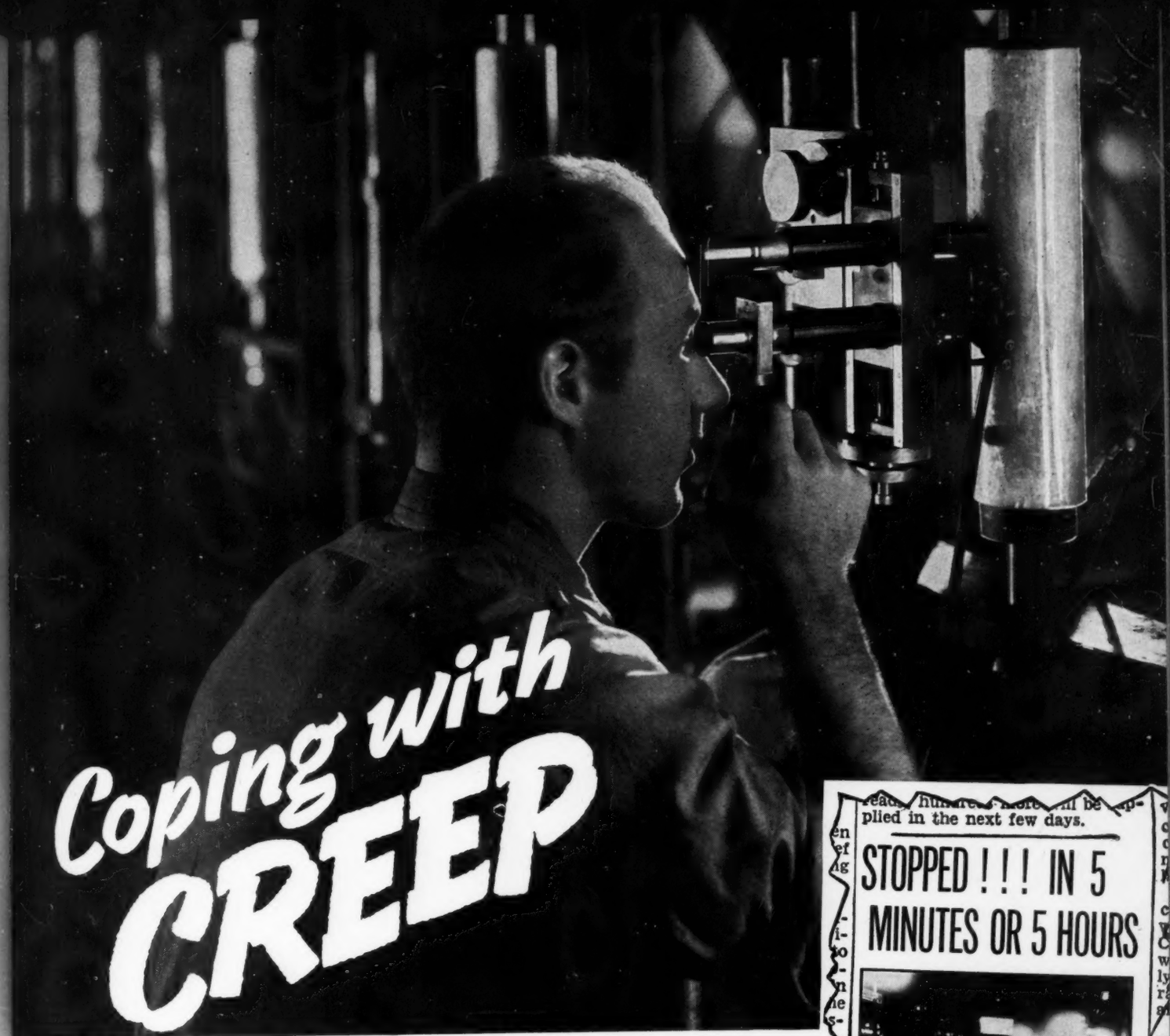
The purity of this Chlorine has been a definite advantage to our trade which has found it the means of avoiding chlorinator irregularities. These men are also glad to know that, in depending on Pennsylvania Salt Manufacturing Company for Chlorine, they are assured quick deliveries of the desired quantity to any point.

To help with your difficult problems, our highly specialized technical service is always available.

PENNSYLVANIA
SALT MANUFACTURING COMPANY

EXECUTIVE OFFICES, WIDENER BLDG., PHILADELPHIA, PA.

BRANCH SALES OFFICES: NEW YORK · CHICAGO · ST. LOUIS · PITTSBURGH · TACOMA · WYANDOTTE



Coping with CREEP

● When you're designing for severe use . . . at high temperatures . . . for many years of service . . . the minute, progressive deformations which slightly alter the original dimensions of the product must be carefully considered. Such deformation, known as "creep," is a permanent stretching or distortion, detectable in even the strongest steels when they are subjected to the high pressures and temperatures which modern industry requires.

Measuring the rates of creep for various metals has long been one of the major studies in the Crane Research Laboratories. Year in and year out, a whole battery of specially built testing machines is in constant operation . . . continually revealing rates of creep. Through these studies, Crane engineers can determine the pressures and temperatures at which creep rate is limited to 1% for 10 years. Only on the basis of such testing does Crane adopt materials for high temperature service.

Producing rugged valves that cope successfully with creep, with wire drawing, with every enemy of valves, is only one of Crane's contributions to industrial progress. Look in your Crane No. 52 Catalog for the details of 38,000 items and dimensions, tested in the laboratory and proved on the job. Use it when you need valves, fittings, pipe or accessories. CranEquip for satisfaction.

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS

Branches and Sales Offices in One Hundred and Sixty Cities

plied in the next few days.

STOPPED ! ! ! IN 5 MINUTES OR 5 HOURS

CHICAGO, ILL., May 14—Let's hope this doesn't happen soon in your city . . . a break in a 5-foot main—the pavement caving in . . . lives and property in danger . . . traffic jammed . . . thousands of gallons of water going to waste.

But if it does, can you stop it in 5 minutes with a Crane motor-operated valve—or must water create havoc while men toil for hours to close a 60-inch valve?

Electric motor operation puts push-buttons at your service—gives you the speed you need in an emergency. And Crane motor-operated valves match that speed with rock-ribbed reliability. Be master of your water system. Install Crane motor-operated valves for quick, positive, control in your big mains whose bursting means tremendous damage.

Refer to your Crane No. 52 Catalog when ready to order your next piping equipment. Use it to make out your order. It will pay you to CranEquip from your waterworks

THESE OUTSTANDING PLANTS KNOW HOW TO HANDLE IT

IF *IT* IS SEWAGE SCREENINGS

Installation Paola, Kansas

They Are Using the Rex Triturator!

Contracts and Installations

Buffalo, N. Y. (6 units)
Greeley & Hansen, Chicago

Denver, Colo. (3 units)
Black & Veatch, Kansas City

Elgin, Ill. (2 units)
Elgin Sanitary District

Sheboygan, Wis. (2 units)
Jerry Donahue Engr. Co., Sheboygan, Wis.

Paola, Kansas
E. T. Archer & Co., Kansas City

Highland Park, N. J.
Waldo S. Coulter, New York, N. Y.

Akron, Ohio
City of Akron, Ohio

Neenah-Menasha, Wis.
Greeley & Hansen, Chicago

Oshkosh, Wis.
Robert Cramer and Sons, Milwaukee

Green Bay, Wis.
Jerry Donahue Engr. Co., Sheboygan, Wis.

Oneonta, N. Y.
W. W. Watkins, Supt., Sewage Disposal

Stockholm, Sweden
Harvey & Jarvis, Copenhagen, Denmark

Since its introduction to Sanitary Engineers a short while ago, the Rex Triturator has established itself as the leading method for shredding bar rack screenings in sewage disposal plants.

Its shearing action that completely disintegrates rags, paper and other forms of organic solids, its low water and power consumption and its substantial, rugged design are fundamental advantages that assure its continued success.

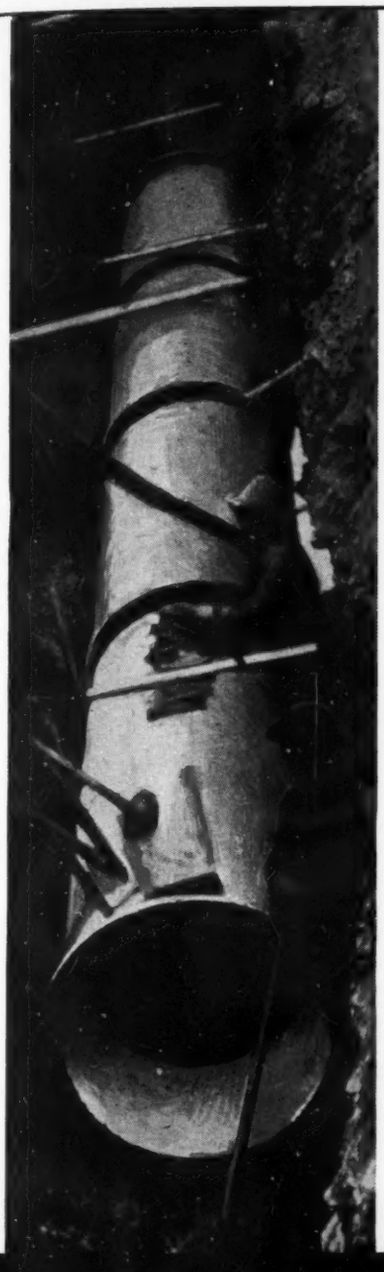
Investigate this proved method of screenings disposal. Send for the Catalog on the Rex Triturator today. Main office address: 1610 West Bruce Street, Milwaukee, Wisconsin.

REX

CHAIN BELT COMPANY
of MILWAUKEE

Sanitation Equipment

Why Make Sanitary Sewer Pipe LARGER Than You Have To?



No longer need you design oversize sewers to allow for infiltration and deterioration. Metal pipe with spun BITUMASTIC Enamel lining has made it unnecessary—since it assures:

(a) Tight joints *that stay tight*, preventing infiltration;

(b) The highest flow capacity known, resulting in smaller pipe sizes; and,

(c) Absolute protection against tuberculation and corrosion.

BITUMASTIC spun lining from tests shows an average Hazen-Williams Coefficient of C=155 on pipe of 16″ dia. and larger and 145 on less than 16″ dia. This is better than .010 for "n" in Kutter's formula, based on longer lengths of metal pipe. As this coefficient should be constant—due to absence of tuberculation and corrosion—the use of BITUMASTIC coating permits reductions in initial pipe sizes because capacities will be sustained, friction materially reduced. The spun lining often pays for itself in less than one year on force mains. Other benefits are listed in the adjacent column.

The use of metal pipe with spun BITUMASTIC lining has been found practical and economical in sanitary sewer installations ranging from 6″ to 60″ dia. Application can be at pipe mill or foundry—or on the job. Further particulars on request.

SPUN BITUMASTIC LINING

REG. U.S. PAT. OFF.

1. Reduces friction.
2. Permits smaller pipe diameters—consequently more footage of pipe.
3. Eliminates deterioration of pipe surface.
4. Maintains highest possible flow for years.
5. Unaffected by sewage or usual industrial wastes.
6. Reduces power requirements for force mains.
7. Permits selecting and operating pumps with maximum efficiency.
8. Saves on excavation costs.
9. Permits use of flatter "slopes" in mains.
10. Eliminates replacement with larger mains in later years.

Bitumastic Products Are Used in Sewage Disposal Plants For:

Bar Screen Mechanism · Aerator Piping · Exteriors of Pumps, Pipes and Miscellaneous Metal Parts · Valve Stands · Hand Railings · Drive Units · Concrete Floors, Walls and Machine Bases · Concrete below sewage level · Pumping Stations · Screen Chambers · Clarifiers · Clarifier Steel Work · Flocculator Tanks · Flocculator Steel Work · Digesters · Digestion Tanks and Covers.

Also Manufacturers of

INDUSTRIAL PAINTS

For All Exterior and Interior Plant Surfaces

WAILES DOVE-HERMISTON CORPORATION

PHILADELPHIA CLEVELAND CHICAGO TULSA, OKLA. SAN FRANCISCO LOS ANGELES

17 BATTERY PLACE, NEW YORK, N. Y.

Laying metal sewer pipe with spun BITUMASTIC lining for Washington Suburban Sanitary District . . . 3745 feet of 30″ and 5558 ft. of 36″ pipe—bell and spigot in 12′ lengths, white washed on outside.

REMOVING MANGANESE

Because it gives a floc that is stable and rapid-settling at high pHs, Ferrisul is an effective coagulant for the removal of manganese. This same characteristic makes Ferrisul valuable for the clarification of:

Highly turbid hard waters which have been softened;

Unsoftened turbid waters of high permanent hardness content;

Soft waters of low color which have a high alkaline condition due to algae growth.

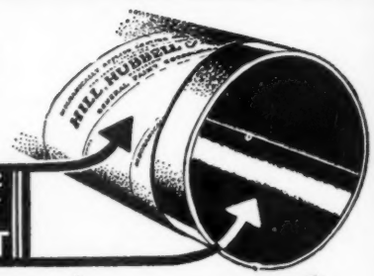
The Ferrisul floc forms quickly at all temperatures and over the entire pH range from 3.5 up. It may be just the coagulant to meet the conditions in your plant. We suggest that you ask your consulting engineers about its use, or write us for further information. Merrimac Chemical Company, Everett Station, Boston, Mass. (A subsidiary of Monsanto Chemical Co.)

Ferrisul
(anhydrous ferric sulfate)
FOR WATER TREATMENT

It will pay to learn what STEEL PIPE Coated by HILL-HUBBELL Process Inside and Out will do for YOU

Because of the improvements made in the past few years in coating materials and in methods of application, STEEL PIPE offers advantages that you should know about. The HILL-HUBBELL Process of MECHANICALLY coating STEEL PIPE, INSIDE and OUT, prevents—corrosion, tuberculation, incrustation, and assures CAPACITY FLOW. This makes it possible to fully utilize the many superior qualities of STEEL PIPE. With the HILL-HUBBELL Process STEEL PIPE is PROPERLY coated at the mill under ideal conditions. It is done MECHANICALLY without the risks involved by hand application of coatings. For your next main or supply line job, find out what STEEL PIPE, coated INSIDE and OUT by the HILL-HUBBELL Process, offers you.

AUSTIN, MINNESOTA
A line of 16" STEEL PIPE mechanically coated, INSIDE and OUT, by the HILL-HUBBELL Process.

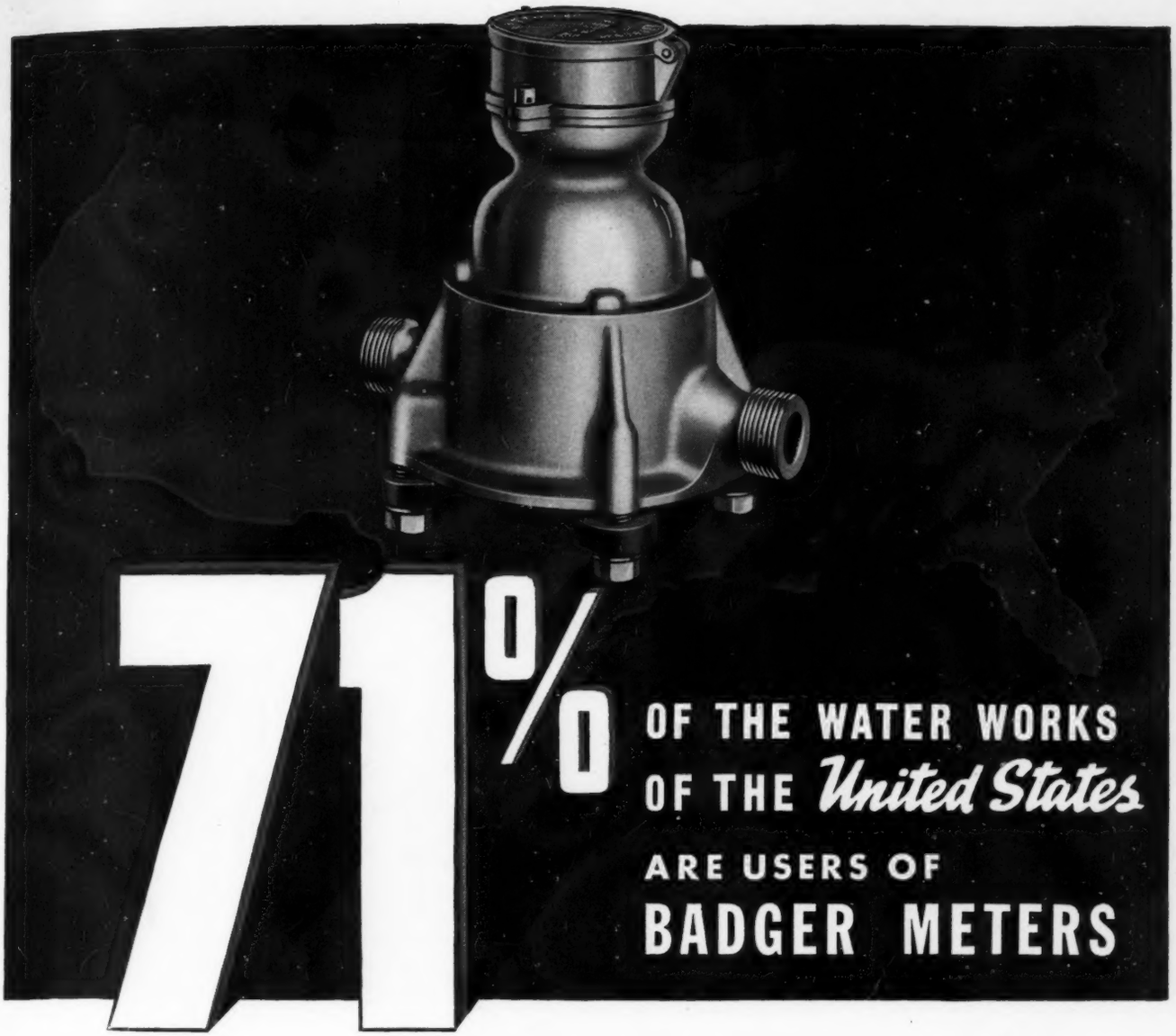


STEEL PIPE coated INSIDE and OUT

Contains Valuable INFORMATION

You will be interested in the method used in applying coating MECHANICALLY. The HILL-HUBBELL Process is described in detail. Use your letterhead and write our nearest office for a copy of "Pipe Protection" which gives complete details and prices.

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
TULSA • SAN FRANCISCO • LOS ANGELES • OAKLAND • PORTLAND • SEATTLE • SPOKANE



71% OF THE WATER WORKS OF THE *United States* ARE USERS OF BADGER METERS

More than five billions of dollars are invested in the nation's water works facilities . . . to provide for an average daily per capita consumption of water in the United States of 100 gallons.

And 71% of the most important systems have purchased Badger Meters for their known dependability and economy of performance. Such amazing majority of acceptance of Badger Meters has been won because Badger Meters deliver service. They take little "time out" for inspection and repairs . . . they emphasize economy of operation . . . they produce maximum revenue by accurate operation. The smallest trickle or maximum capacity flow is faithfully recorded by Badger Disc Meters . . . which have the largest capacities, size for size, with the least absorption of pressure.

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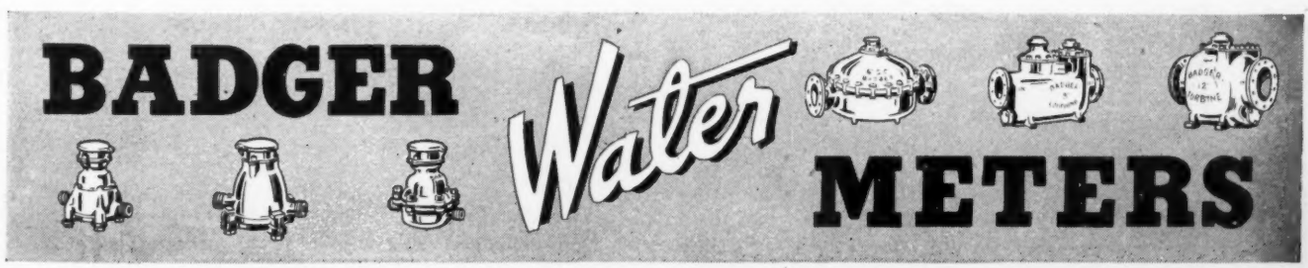

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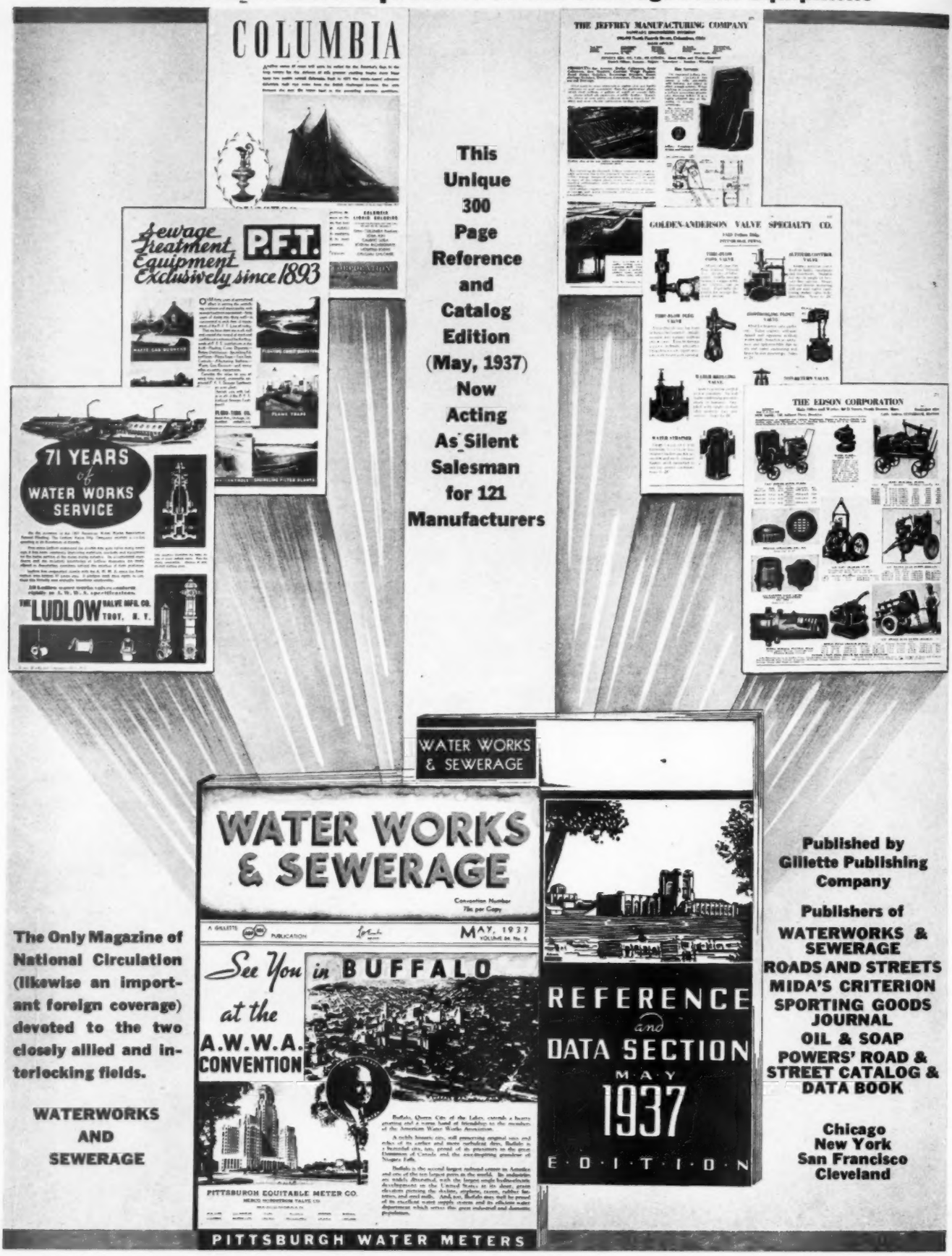
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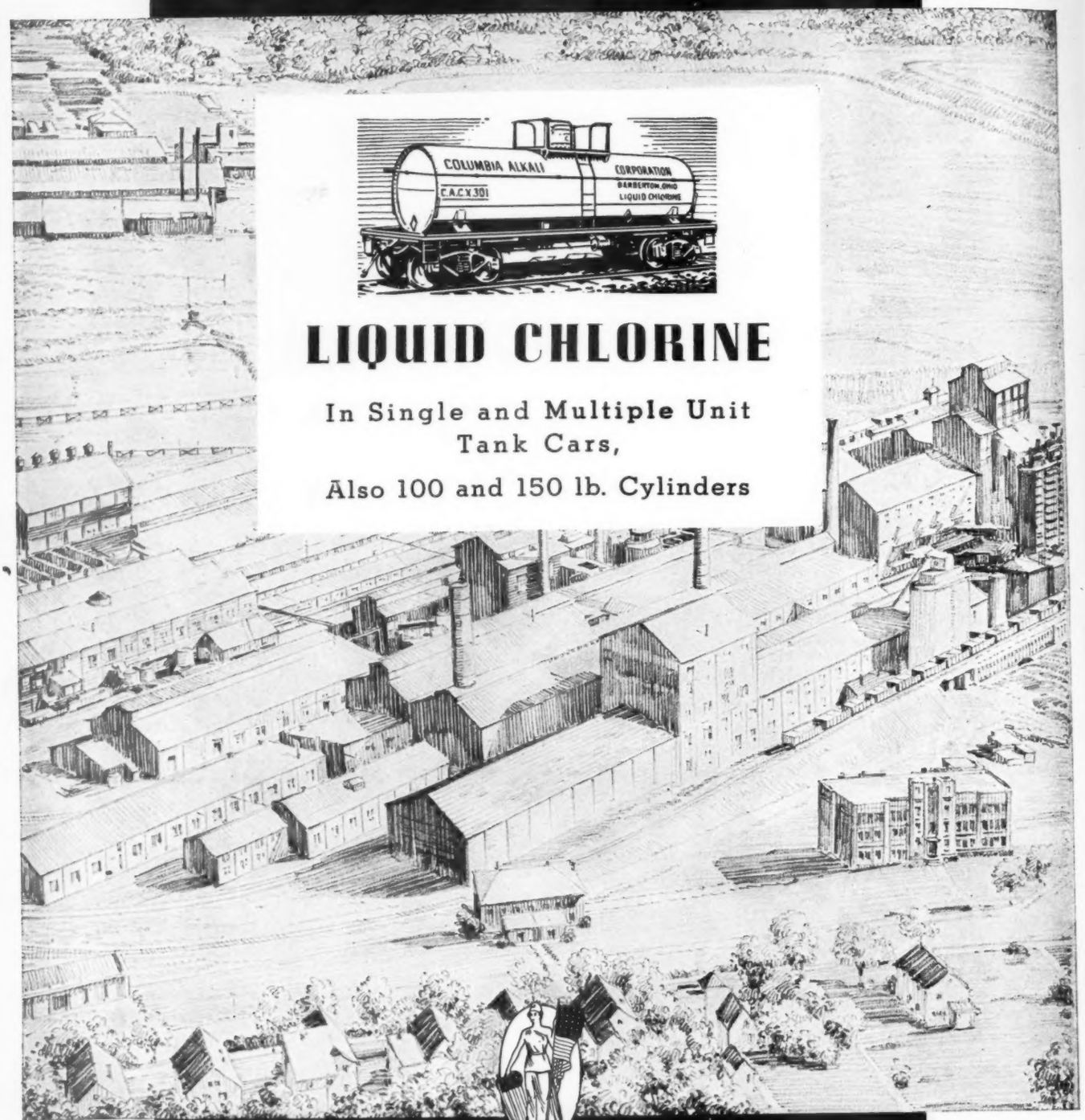

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WATER WORKS & SEWERAGE

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L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"Maintenance of Water Meters"—May have the sound of an oft told story. However, the axiom, **"As the meters go—so goes the revenue!"** sounded by the author of the forthcoming article, is so true that methods looking to better maintenance, and no let up in good maintenance practice, will always prove worthy of space in publications serving the water works industry. Those who have reviewed the material under "Meter Testing Repair and Maintenance," in the Reference and Data Section of our May issue, by **Clem A. Gallagher,** Louisville's Superintendent of Meters and Services, will need no urge to read his forthcoming article. In addition to the fact that this author "knows his meters"—he has the gift of being an easy writer, plus the willingness to give others the benefit of his experiences.

John D. Watson, eminent British Consulting and Designing Engineer, who has to his recent credit England's outstanding 690 M.G.D. Mogden activated-sludge plant, serving 16 communities in the environs of London, has agreed to become a much sought after contributor of a series of articles for the benefit of our readers. The first of these, dealing with "SEWER FLUSHING," is an analysis of what constitutes good and indifferent methods and their resultant effectiveness, or lack of such, under practical conditions. We feel safe in predicting that, as an authority of long and varied experiences, Dr. Watson's contributions will prove amongst the most valuable WATER WORKS & SEWERAGE has ever been in a position to offer its readers. His first contribution was scheduled for this issue, but we are forced to ask forgiveness of author and reader for having to hold it for our August issue.

"Water Softening Improvements at Topeka"—Constitutes a long waited for contribution from Daniel H. Rupp, Topeka, Kansas' Production Engineer, who tells of important improvements in process, design and equipment at Topeka's Water Softening Plant, of which he has charge. Improvements that have been made are those considered desirable and warranted, on the basis of operating efficiency and economics, by an operating chemist-engineer of long experience in water treatment. Here is an "ace" article from an "ace" operator. Intended for this issue, it must be delayed a month due to the lengthy report on the A.W.W.A. Convention.

"The Tank Filter"—A contribution from Dr. H. Bach, well known Chemist of Berlin, Germany, who conceived and with Dr. Karl Imhoff developed the inexpensive "Tauch-Korpfer" method of treating sewage. Dr. Bach's article will prove extremely timely at this stage of high interest in treatment methods involving the precipitation of non-settleable portions of wastes or sewage by bioflocculation, alone or aided by chemicals. Dr. Bach reviews the principles and basic requirements involved; presents plant operating experiences and results; cites and picturizes representative, and long-going, installations of air-fed "Tank Filters," treating industrial and domestic sewages dependably and economically.

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We asked 212 cities whether the *original cast iron lines* in their water distribution systems were still in service—also the age of the oldest cast iron pipe in service. Their answers are shown in the tabulation. Only a material with great bursting strength, beam strength, crushing strength, impact strength, and effective resistance to corrosion—the five indispensable requirements of an underground main—can render such enduring and economical service.

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NOTE: In a few instances gas mains are referred to where they are older than water mains.

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WATER WORKS AND SEWERAGE
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VOL. 84 JULY, 1937 No. 7

THE CEDAR RAPIDS COMBINATION WASTES TREATMENT PLANT

A Brief Description With the First Year's Operating Results

By HOWARD R. GREEN
Consulting Engineer
Cedar Rapids, Iowa

THE first full calendar year of operation of the sewage disposal works of Cedar Rapids, Iowa, has been completed. The construction of this plant constituted part of a $1,500,000 project covering interceptors and treatment units. It represents one of the first cooperative efforts between a municipality and its major industries in solving a river pollution problem on an equitable cost basis.

The Author

The City owns and operates both the general city plant and the necessary pretreatment facilities for industrial wastes. All financing of capital outlay and operating expense is accomplished by sewer rentals which total one-fourth of one cent per capita per day for the actual population, and proportional rates for trade-waste producers.

Conditions under which this plant must operate are both severe and irregular. While the contributing population of the city is only 55,000, the equivalent pollution load (0.15 lbs. B.O.D./capita basis) averaged 163,000 for the year, with monthly averages ranging between 103,000 and 236,000. The highest loadings occur at the lowest temperatures. These conditions are created by a meat-packing plant which frequently exceeds a daily kill of 6,000 hogs and 400 beeves; a corn-products plant processing a grind of one million bushels per month; canning plants with seasonal wastes; numerous creameries and minor food product establishments.

The results of the treatment process have exceeded somewhat the preliminary forecast. Service has been uninterrupted, free from odor nuisance, and all but minor maintenance and operating problems. The plant has demonstrated its ability to absorb "shots" of high concentration waste for protracted periods without upset in any department. The average daily load for the entire year was 7.3 million gallons of 422 B.O.D. sewage-waste. Oxygen demand was reduced 85 per cent to an average B.O.D. of 62 in the effluent. Under adverse temperature conditions (December), a daily load of 6.9 million gallons of 640 B.O.D. material was reduced 87 per cent.

Average gas recovery for the year was 138,000 cu.ft. per day, or 2.5 cu.ft. per capita of actual population. Fourteen thousand cubic feet daily were used for incineration of screenings; 81,000 for gas-engine power generation, and the balance wasted or used for space heating. With a load factor of 83 per cent, 3,000 kilowatt hours of power were generated daily, of which the 65 motor-driven pumps and units of the plant required 2,000, the balance being sold. Standby electric service averaged only 6.6 per cent of plant requirements, or 133 kilowatt hours per day.

Despite the extremely low temperatures of a record-breaking winter, the daily average B.O.D. removal in the filters for the year was 652 lbs. per acre-foot, and the *continuous* sloughing of humus recovered from the filter effluent in the final clarifiers, even during sub-zero weather, was responsible for a daily gas production of at least 30,000 cu. ft.

Two 30-day test runs were made to determine the advantage of mechanically flocculating the raw city sewage, containing a small amount of packing house wastes, without benefit of chemical coagulation. Various constant rates of flow were maintained through the pretreatment plant for at least seven-day periods to determine the permissible velocity of flocculated waste in conduits, and effective sedimentation rates. Tests were also run on packing house waste alone. These tests indicate that chemical dosage of the packing house waste may be omitted until volumetric demands upon the plant increase materially.

The City Plant

Screen and Incinerator.—The first unit of the plant is the screen and incinerator building. All of the general city sewage flow is delivered to this point by gravity, through inverted siphons under Cedar River. The vertical bar screen, some 30 feet below ground surface, is mechanically raked under time-clock control, and the screenings are continuously burned at high temperatures. Approximately 8,000 cu.ft. of sludge gas per day has maintained a non-smoke and odor-destroying temperature, but usually additional waste gas is used.

Pump Station.—The screened sewage reaches the receiving well of the pump station through a 48-inch

[This article, unavoidably delayed in publication, was received in March, 1937.—Ed.]

gravity line. The floor of the pump pit is approximately 32 feet below flood level of the adjacent river and buoyancy is resisted by a system of subdrains leading to a sump served by an automatic pump. Counter-weighting with concrete would have exceeded the cost of this system some $20,000. Raw sewage is pumped through a 48-in. Venturi meter to the grit removal unit some 45 ft. above. Pumping equipment consists of four horizontal units, directly driven by 60 to 150 horse power, 2,300 volt synchronous motors, which provide eleven rates of delivery ranging between 5,000 and 27,000 gallons per minute. Each pump is automatically controlled by individual float switches. An automatic cone-type rotating plug valve on the discharge side of the largest pump saves a friction loss of 11 feet, if comparison is made with usual flap check-valve performance.

The superstructure of the pump station is two stories high. The first floor provides rooms for operators' lockers and power company transformers, as well as an enclosure for all high-voltage control equipment. Connected therewith is a dead-front panelboard serving all switching and starting equipment of the primary plant. Ample laboratory space and superintendent's offices are located on the second floor. The steam heating system of the building is fueled with sludge gas, but standby oil-burner equipment has been supplied also.

Detritor. — After passing through the recording Venturi meter, sewage is passed through a mechanically-cleaned grit removal unit, or detritor. Although the system serves only sanitary sewers, an average of 30 cu.ft. per day of grit has been removed and washed during 1936. The elevation of this unit is sufficient to provide gravity flow through the various units of the plant, involving filter-top elevation above river flood levels.

Grease-Remover. — An air-blown grease removal tank is next in line, the average detention period being 9 minutes under actual 1936 operating conditions. The grease from this unit, together with that skimmed from the surface of the primary clarifier tanks, is conducted by gravity to a concentrating well; the grease is incinerated and the water from the unit flows back into the raw sewage line by gravity.

Primary Clarifiers.—A proportional weir box distributes the sewage flow to one 70-ft. radial flow "Sifeed" clarifier and four 17x65 ft. straight-line clarifiers, all mechanically cleaned. This arrangement provides flexibility of detention period. Such provision was made to cope with the wide fluctuations in rate of flow and anticipated danger of odor-control difficulties resulting from long detention periods of minimum flows. The radial-flow clarifier was designed to accommodate the expected minimum 24-hour load and the smaller straight-line units were provided to be placed in service, as necessary, to absorb the peak rates of flow. The latter are subject to back-drainage to the plant inlet whenever advisable. Under operating conditions, the daily average of suspended solids in the raw city sewage reaching these clarifiers has been 390 parts per million. The year-long average detention period (at 6.5 mgd.) was 2 hours and 43 minutes, or 780 gallons per day per sq.ft. of clarifier area. The average removal of suspended solids has been 65 per cent. The ordinary daily (4 to 5 hour) maximum rate of delivery of raw sewage to the clarifiers has been 9,000 gpm., under which condition a theoretical 82-minute detention period is had and a rate of 1,550 gallons per sq.ft. of area per day results. The greatest month-long load thrown upon the clarifiers was in March. Then, with an average detention period of 1 hour and 54 minutes (area rate of 1,110 gallons per day per square foot), 62 per cent of the suspended solids were removed.

Trickling Filters.—The effluent from the battery of primary clarifiers passes to a pair of interconnected dosing tanks, each of which is equipped with an automatic siphon adequate in capacity for the usual daily peak rates of flow. These siphons discharge through a single line which serves a battery of eight circular trickling filters, each with a diameter of 167 feet and area of one-half acre. At the time of completion this installation constituted the largest diameter filters and most extensive battery of such units yet constructed. The sewage is distributed over the surfaces of the filters by reactance type rotary distributors equipped with staggered spreader jets on each of the four arms. These large mechanisms were individually designed for the eight hydraulic conditions involved, and upon test they bettered the requirement that variation in rate of delivery between any points in the entire 175,000 square foot area be limited to plus or minus 5 per cent. The average depth of the 1½-inch to 2½-inch sized (local limestone) filter media is 6½ feet. The subdrain system set in the concrete floor of the filters is so designed that at maximum rates of flow, the depth of liquid in each line will not exceed the radius of the circular subdrain. At least 10 square inches of drainage and areation ports are provided for each foot of length throughout the 22 miles of subdrain required. Inspection and drainage galleries are provided, the latter being valved so that any individual unit may be flooded for fly destruction if desired; also, so that the effluent from any unit may be delivered to the final clarifiers or to the river outlet direct.

Final Clarifiers.—A pair of rectangular clarifiers is located in the area between each set of four filter units. The humus collected by these units is automatically discharged into collection and concentrating sumps through quick-opening valves. These valves serve the several cross channels set in the clarifier floor at 11-foot intervals along its length. The sludge scraping mechanism automatically trips the valves. The result of this operation is that the period of time during which the sludge is retained in the tanks and the distance which it must be moved to an outlet are reduced to a minimum; thereby, being removed in a fresher condition and more completely so.

Packing Waste Pre-treatment Plant

The meat packing plant cooperated in preparing its wastes for treatment by the installation of 60-mesh screens and additional grease traps serving all sewer lines within the plant. The effluent from these units goes by gravity to an automatic lift station (see cut) served by three vertical type sewage pumps having a total rated capacity of 3,600 gpm. against the required 50-ft. total dynamic head. These pumps of various capacities are controlled by an automatic float-operated program switch. At this point, an overflow or bypass connects with the gravity sanitary sewer so that, in the event of accident in the remote pumping station, packing wastes mix with the city sewage and pass through the general plant. The packing waste pumps discharge through a 14-inch pressure line which crosses Cedar River upon a railway bridge and continues to the pretreatment plant located adjacent to the primary clarifiers of the main city plant. Because of the abnormally high peak rates of flow occurring at various hours of the day during the packer's operations, a 360,000 gallon capacity storage tank rides on the discharge line from the pump

Plate 1.—The Cedar Rapids Combination Wastes Treatment Works. (See Key Diagram.)

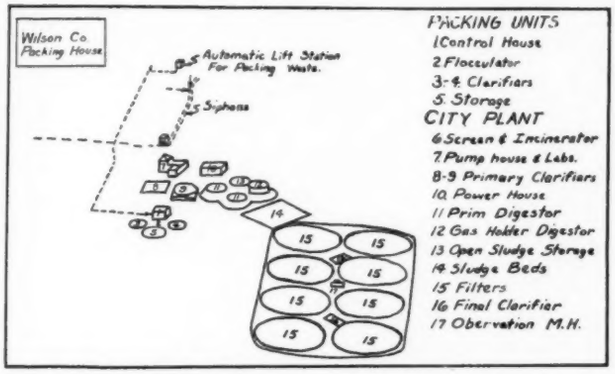


Plate 2.—Key to Plate 1, Picturing Cedar Rapids Sewage Treatment Works.

station. From the equalizing-storage tank, the rate of delivery of raw wastes to treatment units is governed by a standard rate of flow controller. The waste passes through a cone bottom cylinder-type air-blown grease removal unit. From this unit it may either pass through a flash-mix unit and flocculator, before going to two circular clarifiers subject to series or parallel operation, or it may be conducted to one of the clarifiers for plain sedimentation first, then to flocculation and a second stage of sedimentation. The control building houses chemical storage tanks for both sulphuric acid and ferric chloride in the basement and the material is elevated for daily use by compressed air bled from the starting tanks of the gas engine-generator set, later described. Dry-feed machines for the dosing of lime (either for chemical precipitation or for the correction of pH of the clarified waste before going on to the limestone filters) are also installed on the operating floor. Sludge pumps of displacement type are located in the basement of the building.

The effluent from this chemical precipitation plant is automatically delivered by centrifugal pumps to the filter dosing-tanks of the main city plant where it is mixed with the clarified city wastes prior to filter application. An alternate arrangement provides for the effluent of the pretreatment plant flowing by gravity back to the suction side of the pumps of the main city plant where it may be mixed with the raw city sewage and passed through the general clarifiers if desired. Very satisfactory results have been secured by passing the raw wastes through the flocculator, where mechanical coagulation results, and then through the two clarifiers in parallel before mixing with the clarified city waste. A small dosage of ferric chloride was used during the summer months primarily for the beneficial effect in odor control at the filters.

Sludge Disposal

Normally, the sludge from the final clarifiers is discharged into the flow of general city sewage prior to passing through the grease removal unit and primary clarifiers. The sludge from all other clarifiers is pumped directly to a battery of four circular digestion tanks, 60 ft. in diameter and 27 ft. in depth. Two digesters are equipped with floating covers, one serving as a gas holder of 70,000 cu.ft. capacity. The fourth is used as

an open storage tank. The three covered digesters are well equipped with heating radiators supplied from the cooling system of the gas engine. In normal operation, raw sludge from all sources is pumped for two-day alternate periods to the tanks equipped with floating covers. Partially digested sludge is periodically transferred to the unit equipped with the gas-holder, wherein second stage digestion is had. The open storage tank is used from time to time as desired. Supernatant liquors, drawn from the second stage digester, are discharged into the incoming raw city sewage. No difficulty has been experienced in maintaining temperatures in the 90° Fahrenheit range, using only the cooling water from the gas engine when in normal operation. However, a waste heat boiler is available on the exhaust line of the engine and an auxiliary gas-fired boiler may be used, if the engine should be down for repairs or maintenance. Experience indicates that auxiliary engine cooling should be provided during the summer months as the average temperature of the sludge, heated only by the cooling water of the engine, exceeds the desired level during four of the summer months. However, no objectionable sludge digestion results were experienced, even when the average temperature for a 30-day period stood at 108 degrees in all three tanks.

Digested sludge is drawn from the open storage tank into a day tank serving a vacuum filter, or it may be discharged by gravity to standard sand-drying beds if desired. The available area of drying beds, however, is merely sufficient for standby purposes and to supply a dried sludge for use on a golf-course. Uniformly excellent results have been secured through the use of the vacuum filter, the quantity of material so dewatered being determined by the demand for filter cake as lawn dressing and fertilizer. A considerable quantity of digested sludge has been used as fill material on a low area within the plant site. At no time has there been any indication of foaming or incomplete digestion of sludge, and no other difficulties with digestion have been encountered.

Gas Utilization—Power Generation

A separate power plant building houses a gas engine-generator set and a vacuum sludge filter and provides space for a future engine installation. All auxiliary equipment for both machines is housed in the basement, which connects with a force-ventilated tunnel serving the four digestion tanks.

The engine is a five-cylinder, 210 H.P., 300 r.p.m., 65 b.m.e.p. unit, direct-connected to a 2300-volt, 3-phase, 60-cycle alternator with direct-connected exciter. Both units are mounted on a continuous cast iron base supported by a 12-foot high solid concrete foundation resting on 6 inches of compressed cork which completely damps all building vibration.

The generator rides on the line of the local utility company and energy is metered in and out. Protection devices shut down the engine in the event of overloading, overheating, failure of water or oil circulation system, etc. Practically all switching and control is automatic. Auxiliary equipment includes duplicate gas pumps maintaining constant gas pressure under the floating covers of the digesters and delivering surplus gas through separate meters to the gas holder; gas purifier; meter; flame trap; waste heat boiler and silencer on exhaust line; air purifier; oil and water circulation pumps; oil filter; air starting equipment, pyrometer, etc.

The cooling system of the engine is served by duplicate circulating pumps driving hot water to the coils in three of the digestion tanks. Alternate water circuits pass through the exhaust gas boiler and a gas-fired auxiliary boiler which can be used separately or in series with the engine. It is planned to install an equal footage of radiation in the primary clarifiers, for additional cooling of the recirculated water when sludge temperatures exceed optimum.

Comments on Operation

The plant is operated under the direct supervision of the City Engineer, F. E. Young; with J. C. McIntyre as plant superintendent; W. W. Walker, plant chemist;

TABLE 1.—5-DAY B.O.D. REMOVALS AND FILTER LOADING DATA—CEDAR RAPIDS

	Primary Treatment										Secondary Treatment (Filters and Clarifiers) — Combined Wastes							
	General City Sewage					Packing House Waste												
		BOD in P.P.M.			Pounds		BOD in P.P.M.			Pounds		BOD in P.P.M.			Pounds			
1936 Month	MGD	(Raw)	(Setld)	% Reduced	BOD to Filters	MGD	(Raw)	(Setld)	% Reduced	BOD to Filters	MGD	Applied	Effluent	% Reduced	BOD Removed in Filters	Acre Ft. Used	Pounds BOD Removed per Acre Foot	MGAD Filter Load
Jan.	5.3	421	321	23.6	14,100	0.784	841	595	29.4	4,120	6.08	362	74	80	14,540	21.4	680	1.85
Feb.	5.7	427	293	31.4	13,800	1.250	578	396	31.5	4,390	6.95	315	104	67	12,190	15.8	770	2.86
Mar.	9.3	297	230	22.5	17,500	1.250	404	275	32.0	3,410	10.55	240	56	77	16,210	26.0	624	2.64
Apr.	9.0	376	268	28.8	21,800	1.000	796	535	32.8	5 200	10.00	325	68	79	21,350	25.0	856	2.60
May	7.5	452	348	23.1	21,600	0.313	630	464	26.3	1,255	7.81	353	84	76	17,450	19.5	890	2.61
June	4.7	317	237	25.2	9,340	0.480	724	522	27.8	2,060	5.22	264	45	83	9,450	19.1	495	1.78
July	4.6	332	245	26.2	9,250	0.710	750	513	31.5	3,185	5.26	285	39	86	10,735	21.7	495	1.58
Aug.	6.5	358	273	23.6	14,700	0.775	715	492	31.2	3,300	7.28	299	36	88	15,830	19.5	810	2.43
Sept.	6.8	282	213	24.6	12,100	0.745	564	359	36.3	2,540	7.59	233	37	84	12.320	26.0	474	1.98
Oct.	6.3	317	244	23.0	12,800	0.715	641	404	37.0	2,740	7.06	266	48	82	12,740	26.0	490	1.77
Nov.	6.7	484	340	29.7	18,700	0.670	710	475	33.0	2,640	7.32	310	67	81	17,290	26.0	565	1.83
Dec.	6.4	596	376	37.0	19,900	0.510	1,169	556	47.7	2,600	6.91	392	84	79	17.670	26 0	679	1.73
Average (Weighted)	6.5+	390	282	27.7	15.255	0.8—	681	456	33.0	3,120	7.3	304	62	79.7	14,815	22.8	652	2.14

Note: Avg. daily reduction of BOD for year through plant was from 422 to 62 or 85.3%.

TABLE 2.—1936 RECORD OF SUSPENDED SOLIDS REMOVALS—CEDAR RAPIDS

	General City Sewage						Packing House Waste									Combined Wastes — Plant Effluent						
	Raw			Settled			Raw				Settled											
			Susp.		Susp.	% Re-		Temp.		Susp.	Lbs.	$FeCl_3$		Susp.	% Re-			Susp.	% Re-			
1936 Month	MGD	pH	Slds.	pH	Slds.	duced	MGD	°F.	pH	Slds.	Lime	Gals.	pH	Slds.	duced	MGD	pH	Slds.	duced	NO_3N	D.O.	BOD
Jan.	5.3	7.1	431	7.1	152	64.3	0.78	83	6.8	564	600	..	7.9	157	69.9	6.08	7.4	127	71.7	30	5.8	74
Feb.	5.7	7.2	374	7.2	138	62.1	1.25	64	7.2	569	930	..	8.3	114	75.0	6.95	7.4	75	82.4	8	4.1	104
Mar.	9.3	7.2	367	7.3	135	61.7	1.25	58	7.1	356	950	..	8.4	108	69.3	10.55	7.2	67	81.7	8	5.6	56
Apr.	9.0	7.2	343	7.0	133	60.0	1.00	67	6.8	477	300	..	7.5	151	67.5	10.00	7.1	102	71.4	19	3.6	68
May	7.5	6.8	361	6.8	139	60.6	0.31	64	6.7	491	...	..	6.9	137	71.7	7.81	7.2	59	84.0	4	0 8	84
June	4.7	6.8	328	6.9	118	62.5	0.48	66	6.8	536	40	3	6 9	148	72.0	5.22	7.3	42	87.9	4	3.5	45
July	4.6	6.8	296	6.9	108	62.9	0.71	76	6.8	543	225	40	7.0	153	70.5	5.26	7.2	36	89.4	5	2.2	39
Aug.	6.5	6.8	354	6.9	117	64.7	0.78	79	6.8	544	...	31	6.9	169	68.3	7.28	7.3	31	91.7	2	1.8	36
Sept.	6.8	6.8	348	6.9	118	64.0	0.75	84	6.9	530	...	10	7.0	137	72.8	7.59	7.3	46	87.5	4	3.8	37
Oct.	6.3	6.8	364	6.9	117	66.8	0.72	85	7.0	522	...	..	7.1	148	70.3	7.06	7.3	64	83.2	8	4.4	48
Nov.	6.7	6.9	480	6.9	127	72.8	0.67	83	7.0	540	...	..	7.1	150	72 2	7.32	7.3	61	87.6	11	4.3	67
Dec.	6.4	6.8	562	7.0	128	72.6	0.51	80	7.0	815	...	..	7.0	125	80.1	6.91	7.3	93	84.0	18	3.8	84
Average..	...	...	...	...	...	64.6	....	..	...	...	...	..	...	...	71.5	....	...	67	84	..	...	..

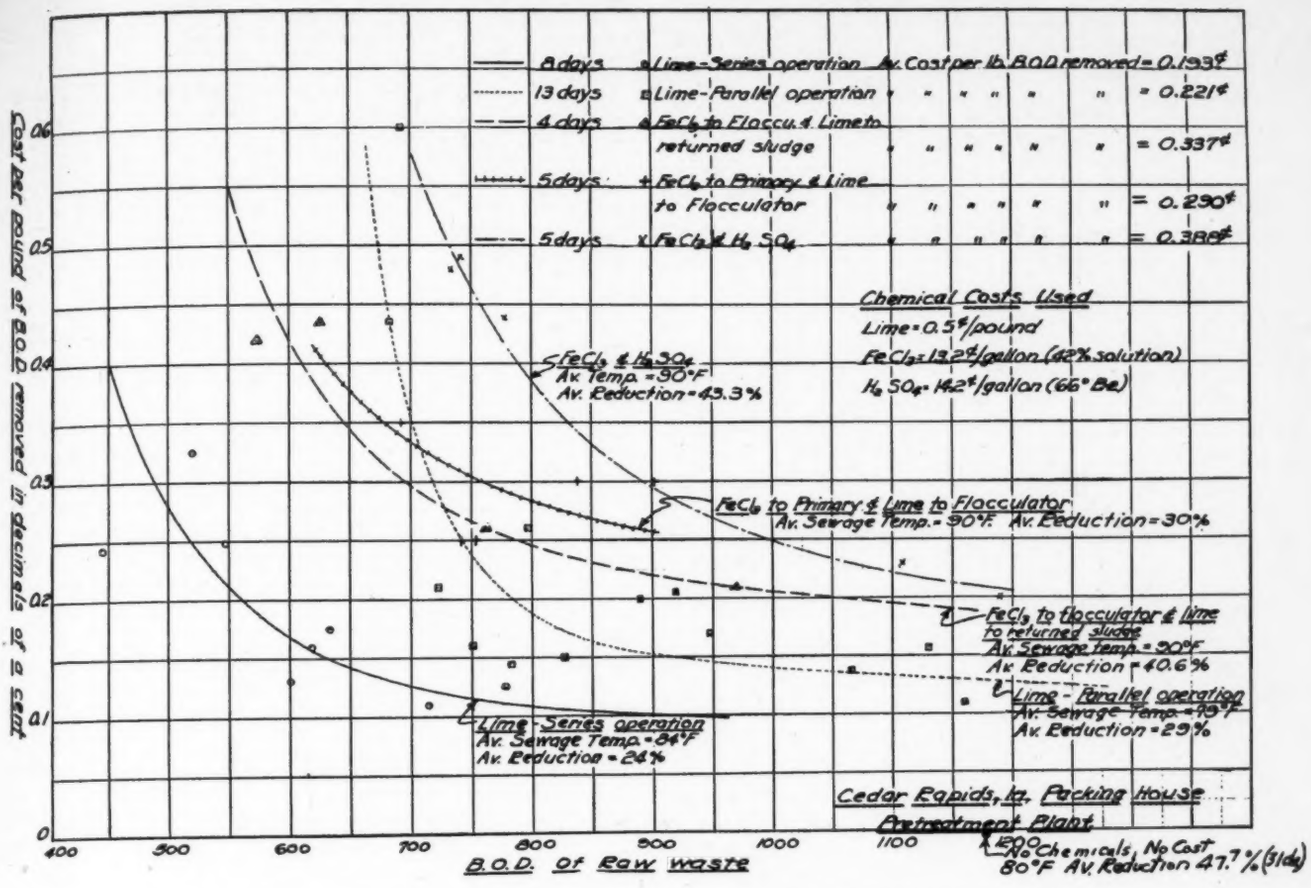

8 days + Lime-Series operation Av. Cost per lb. B.O.D. removed = 0.193¢
13 days + Lime-Parallel operation " " " " " " = 0.221¢
4 days + FeCl3 to Floccu. & Lime to returned sludge " " " " " " = 0.337¢
5 days + FeCl3 to Primary & Lime to Flocculator " " " " " " = 0.290¢
5 days x FeCl3 & H2SO4 " " " " " " = 0.388¢
Chemical Costs Used
Lime = 0.5¢/pound
FeCl3 = 13.2¢/gallon (42% solution)
H2SO4 = 14.2¢/gallon (66° Be)
FeCl3 & H2SO4 Av. Temp. = 90°F Av. Reduction = 43.3%
FeCl3 to Primary & Lime to Flocculator Av. Sewage Temp. = 90°F Av. Reduction = 30%
FeCl3 to flocculator & lime to returned sludge Av. Sewage temp. = 90°F Av. Reduction = 40.6%
Lime - Parallel operation Av. Sewage Temp. = 79°F Av. Reduction = 29%
Lime - Series operation Av. Sewage Temp. = 84°F Av. Reduction = 24%
Cedar Rapids, Ia. Packing House Pretreatment Plant
No Chemicals, No Cost 80°F Av. Reduction 47.7% (31 days)
Cost per pound of B.O.D. removed in decimals of a cent
B.O.D. of Raw waste
0 0.1 0.2 0.3 0.4 0.5 0.6
400 500 600 700 800 900 1000 1100 1200

Plate 3.—Chemical Precipitation Costs in Cents per Pound of B.O.D. Removal. (A Study of Various Treatments on Waste of Varying Strengths.)

and the writer's firm as consultants. The operating data appearing herewith have been prepared and released through the courtesy of the above officials.

In general, the plant has been operated under regular routine methods, but the flexibility of the units and the nature of the wastes available are such that rather unusual opportunity for research along various lines is afforded. A considerable amount of such investigation has been carried out during the past year, some of which was in cooperation with equipment manufacturers.

Oxygen Demand Removal

Reductions in B.O.D. of the various wastes en route through the system are shown in Table 1. The B.O.D. of raw city wastes was affected somewhat by the addition to it, from time to time, of meat packing wastes in various amounts. The arrangement at the packing plant is such that condenser water may be added to the sewage flow at will for the purpose of increasing general temperatures through the plant, but this option was not exercised to any great extent. The B.O.D. figures for raw packing house wastes indicate in general the concentration as regularly produced. The B.O.D. of material applied to the filters represents the weighted average of the mixed wastes as coming from the respective clarifiers. The acre-feet in use from month to month varies somewhat with plant routine and the pounds of B.O.D. removed per acre-foot are based on the actual volume of filter media in use.

It will be noted that primary treatment of the city sewage was responsible for an average of 27.7 per cent B.O.D. reduction. Primary treatment of packing house wastes effected a yearly average of 33 per cent reduction, while the filters effected a 79.7 per cent reduction in the materials applied to them and the average for the year through the entire plant was 85.3 per cent.

Chemical Precipitation Results

Numerous trial runs at 1,000 g.p.m. continuous flow for periods of from 5 to 13 days were made in the packing house pretreatment plant for the purpose of determining the performance at various chemical dosages, sequence of treatment, and concentration of wastes. The results of these trial runs are shown on Plate 3. As might be expected the cost of chemicals per pound of B.O.D. removal decreased as the concentration of material under treatment increased. The best reduction procured was 40.6 per cent when flocculating with ferric chloride and adding lime to sludge returned from the secondary clarifiers. The return of chemically precipitated sludge to the incoming wastes, to assist in flocculation could be continued for only a limited period of time. After 4 to 6 days of such recirculation septicity usually built up to an objectionable degree. The cost of the B.O.D. removal under this last and most successful type of chemical precipitation was approximately one-third of a cent per pound, whereas equivalent results were secured for a 31-day period by flocculating the raw wastes without the use of any chemicals and then passing through the two clarifiers in parallel. Therefore, at present the plant is normally operated on this basis. During periods of exceptionally high loading, or when precautionary measures for odor control on the filters appears desirable ferric chloride is applied.

TABLE 3.—SLUDGE, GAS, AND POWER DATA—CEDAR RAPIDS

	Sludge and Gas Data							Gas Used per Day in 1,000 Cu. Ft.			Power Data						
1936 Month	Pop. Equiv. Thous.	Total Solids Added to Dig., Daily Thous. Lbs.	% Volatile	Cu. Ft. of Gas/Lbs. Vol. Sol.	Temp. Sludge ° F.	Cu. Ft. of Gas Recovered Thous.	Gas B.t.u. per Cu. Ft.	Incinerator	Heat Bldgs. & Waste	Engine	KWH Generated	Cu. Ft. per KWH	B.t.u. per KWH	KWH Required by Plant	KWH Sold	KWH Bought	Load Factor on Gen.
Jan.	168	16.4	74.7	10.9	93	131	...	10	22	99	3,500	28.2	.....	1,820	1,700	20	97
Feb.	169	14.5	78.4	10.4	91	119	585	10	29	80	2,990	26.8	15,700	2,080	1,340	450	83
Mar.	184	21.5	71.6	8.2	89	126	590	15	21	90	3,350	26.9	15,900	2,670	890	210	93
Apr.	175	17.3	76.1	9.9	95	130	623	14	27	89	3,450	25.8	16,100	2,020	1,450	20	96
May	189	19.2	77.1	9.9	100	146	...	12	47	87	3,560	24.4	.....	2,070	1,490	0	99
June	103	20.6	76.4	9.4	95	147	...	11	48	88	3,650	24.1	.....	2,040	1,610	0	101
July	114	17.3	77.9	9.8	97	132	613	11	81	40	1,540	26.0	15,950	1,730	645	835	43
Aug.	146	17.8	77.8	10.0	103	139	...	14	48	77	2,630	29.2	.....	1,780	850	0	73
Sept.	122	20.0	75.6	9.2	108	139	594	13	48	78	2,750	28.3	16,700	2,000	750	0	76
Oct.	150	17.7	78.1	9.7	104	133	...	16	34	83	2,800	29.6	.....	1,840	960	0	78
Nov.	197	18.5	77.9	9.5	90	137	597	..	..	..	2.600	...	.....	1,720	965	85	72
Dec.	236	20.0	78.8	9.6	94	176	593	24	67	85	3,060	27.8	16,500	2,140	920	0	85
	163 Av.					138 Av.					2,990			1,992	1,131	133	

Filter Performance

In view of the discussions of high-rate filters in current literature, the day-to-day results of routine operation in this plant are interesting. Regardless of temperatures, strength of wastes, or volume applied, the percentage of B.O.D. removal remains encouragingly uniform, never departing far from the 85 per cent annual average. For the sake of comparison with other installations upon which year-round records have been published, Table 4 is presented. It shows plants operated under similar climatic conditions and reporting upon year-round operations.

Contrary to much published material, sloughing of filter humus (in this plant at least) while not entirely uniform is at least copious and continuous. When the filters were thrown out of operation because of a severe blizzard with drifting snow (January 21 and again on February 20) the quantity of sludge recovered and gas produced dropped precipitously and markedly. The recovery of efficiency by the zero-temperature filters, when again placed in service, was slow but steady and the gas production curve worked upwards with like trend. Indeed, so far as this plant is concerned, it is clearly demonstrated that the recovery of secondary sludge is profitable as a power-producing operation. The normal recovery of gas from filter humus during periods between major sloughing cycles has been about 0.235 cu. ft. per capita equivalent (on a 0.15 lbs. B.O.D. basis) per day. On the basis of an annual average population equivalent of 163,000, a daily average of gas production attributable to this source is 38,000 cu. ft. The gas engine under operating conditions averaged a consumption of 27.8 cu. ft. of gas per kilowatt hour metered at the switchboard. Therefore, filter sludge was accountable for 1,380 kilowatt hours per day. If purchased from the local privately owned utility at one cent per kilowatt hour, this amount of additional current has a value of $13.80 per day, which is equivalent to approximately $5,000 per year. In addition to this recovery, the heat value of cooling water under local conditions is worth $200 per month, during the colder six months of the year. Against the total value of heat and power recovered of $6,200 per year must be charged the additional investment and operating cost involved. 38,000 cu. ft. per day would warrant the installation of an additional 90 horse power of capacity, which at $124 per unit would require an investment of approximately $11,200. Additional digestion capacity on the basis of 48,000 cu. ft. per 100,000 population equivalent and costing 25 cents per cubic foot, including accessories, amounts to approximately $19,500. Therefore the total required additional investment would approximate $30,700. To finance this, at current rates of interest over a 20-year period on a serial retirement basis, amounts to about $2,700. Figuring annual engine repairs at 10 per cent necessitates another $1,120 charge, and lubricating oil and supplies at 20 cents per horse power per month would amount to $216, making the total annual charge against the improvement $3,600. This indicates a net annual profit in favor of the digestion and by products recovery of filter humus of $2,600 per year. If power rates were higher, a still greater profit would ensue.

Gas Production

An interesting series of records has been compiled upon the relation of gas production to fresh solids added to each of the two primary digesters. Plate 4 indicates typical results for a one-month period. It will be noted that upon the addition of fresh solids to any digestion tank, the quantity of gas produced immediately accelerates tremendously, but this rate of production of gas persists for only a 24-hour period after terminating the addition of fresh solids. Thereafter, the rate of production decreases rapidly, and after a period of four days is only 20 per cent of the maximum rate. A careful record of pounds of volatile solids added to one of the digesters was compiled and continued for a period of 40 days. Making due allowance for the rate of gas production from the unit at the time of commencing the observations, it was found that the production of gas, in cubic feet per pound of volatile solids added, reached 4.4 during each of the first and second 24-hour periods; 7.4 during the third day; 9.6 during the fourth day; and 11.1 during the fifth day; thereafter the rate remained substantially the same, never exceeding 12.3, or dropping below 9.5.

This variation of digester performance, revealed from many study curves, is of very practical importance for the following reason: A plant such as this may de-

TABLE 4.—COMPARATIVE TRICKLING FILTER LOADINGS AND REMOVALS AT REPRESENTATIVE PLANTS

Plant	Filter Depth	Filter Load in MGD		BOD in P.P.M.			Lbs. of BOD Removed per Acre Ft.	Source of Report
		Date	per Acre	Per Acre Ft.	Influent	Effluent	% Reduced	
Cedar Rapids	6.5	12 mo., 1936	2.14	0.329	304	62	79.7	652	City Operators
Chicago (Exprmtl.-High Rate)	8.0	12 mo., '35-'36	20.2-26.2	2.52-3.28	47.6	24.3	48	470	Mohlman, S. W. Jrnl., Nov., '36
Decatur	6.0	24 mo., '30-'31	3-3.33	0.50-0.56	75-81	15-16	80-80.3	278-271	do
Calumet, Chgo.	6.5	36 mo., '25-'27	2.31-2.66	0.356-0.409	69-55	22-17	47-58	130	do
Akron	10.0	12 mo., '35	2.12	0.212	120	18.4	84.7	164.9	Hall, S. W. Jrnl., Jan., '37
Cleveland, south'ly	6.0	12 mo., '35	1.65	0.275	122	25	79.6	197.5	do
Norwalk	8.0	12 mo., '35	1.73	0.216	170	21	87.7	239.7	do

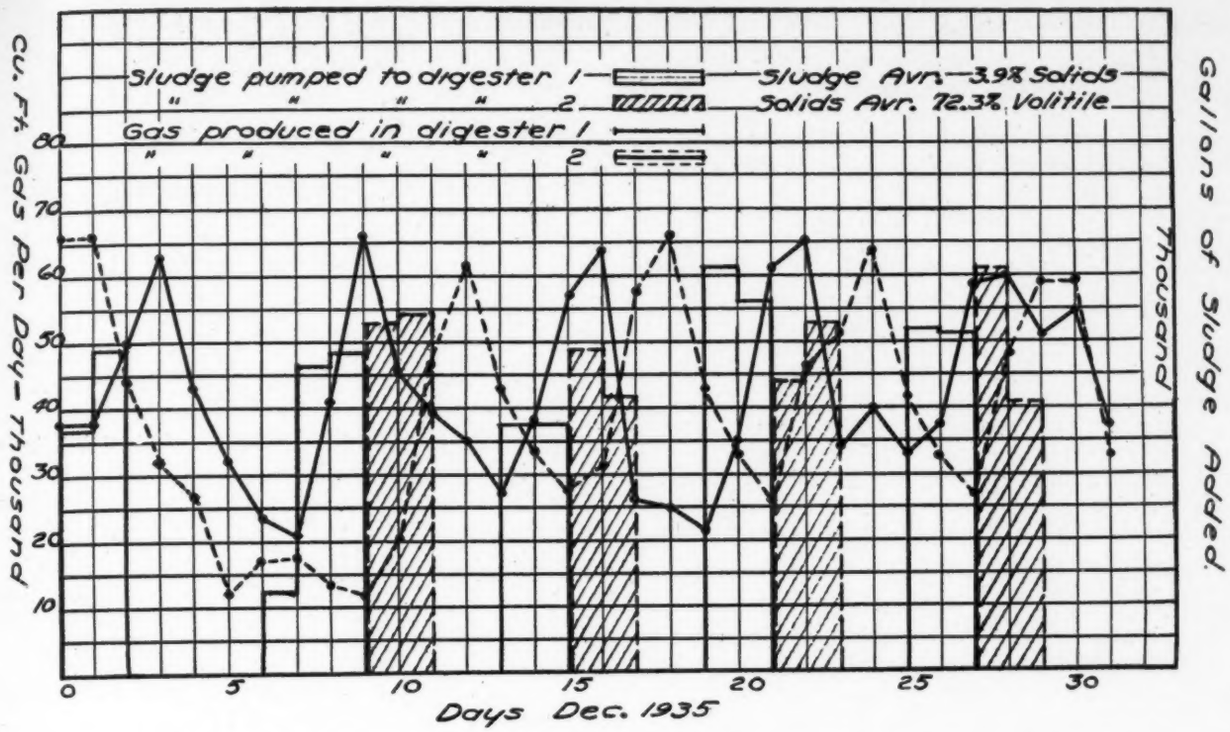


Plate 4.—Relationships Between Sludge Pumpage to Digesters and Rates of Gas Production—Cedar Rapids.

pend upon gas engines for continuous power service only so long as fresh volatile solids are regularly added to the digesters. The storage capacity of the digestion tanks cannot be depended upon for average fuel production beyond a 24-hour period, following cessation of adding sludge. During flood periods, when the rate of infiltration to the sewer system is high and the need for power in pumping is greatest, the rate of flow through primary clarifiers is high and the recovery of volatile solids is expected to be low, resulting in a depletion of fuel at the very time when it would be most valuable in plant operation. Therefore, standby service or abundant gas storage is not only advisable, but vital to the continued operation of the Cedar Rapids plant if flood protection is one of its objectives.

Value of Multiple Digestion

In a plant such as this which must be prepared at all times to accept and process highly variable quantities of sludge produced by various industries in addition to the more uniform volume of solids recovered from domestic waste, the availability of multiple digestion units is highly desirable. The operating history during 1936 indicates that the quantity of sludge added daily to the digesters was in the neighborhood of one gallon per capita of actual population per day. The percentages of total and volatile solids remain reasonably constant.

On numerous occasions, the total quantity of sludge collected was pumped to one primary digester for several consecutive days. On each such occasion, the production of gas from that digester increased immediately and this acceleration continued as long as the routine was followed. The turbulenee which resulted from this procedure after the third day closely resembled a foaming condition and gas production after the third day overtaxed the capacity of the meter serving the digester in question. However, the cubic feet of gas per pound of volatile solids added remained constant.

On the other hand, if two or three digestion tanks were charged in two-day cycles, the gas production and objectionable turbulence in any given unit subsided during the two or four-day interim between charges, and no total irregularity of gas production nor individual turbulence was noted. In other words, a 580,000 gallon digester holding—say 375,000 gallons of actively fermenting sludge—demonstrated that it was capable of absorbing 60,000 gallons of fresh sludge per day (16 pct. by volume) for two or possibly three days without difficulty. During this period the gas production would increase from 25,000 c.f.d. to 65,000 c.f.d., and if continued, objectionable turbulence would occur. But if the unit was allowed to rest after the second day, the gas production would drop again to 25,000 c.f.d. in from two to three days and be ready for additional loading. This sequence seemed to result in better performance than when dividing the daily increment of sludge equally between two or three units. Possibly because of the violent mixing effect of high gas production in the former case. Reasoning on this basis, it would appear that two 300,000 gallon units offer equal capacity (certainly more flexibility) than a single units of 600,000 gallons capacity. Additional factors found to favor multiple units are continuity of service when maintenance is necessary in any one unit and also flexibility of procedure as between parallel and series operation. Along this same line, experience with this and numerous other plants, including smaller ones, indicates the advisability of always having an additional unit, or at least an open storage tank equivalent in capacity to the largest digester in the plant.

An example of this general procedure is shown on Plate 4. Here for the most part sludge was added in two-day cycles in each of three heated tanks. The sludge added to and the gas produced by No. 3 is not shown as no separate meter serves that unit; but the satisfactory performance of Nos. 1 and 2 when operating on a two-day charge and four-day rest basis is apparent.

Gas-Engine Operation

Table 3 indicates the month-to-month performance of the engine-generator set. It will be noted that during the first six months of the year, the unit was operated continuously at almost full load. At the termination of this period (12 months of operation having been completed) the engine was given a general inspection and overhauling for maintenance purposes. Some pitting from hydrogen sulphide in the digester gas was noticed, although preliminary analyses of the gas resulted in negative reports on this point. Therefore a purifier was installed in the gas line leading to the engine to eliminate this difficulty. The Cedar Rapids installation offers an excellent opportunity for the determination of B.t.u.'s necessary per unit of power. The factor of error(as when horse power is computed) is reduced to a minimum because the end product (KWH) is accurately measurable, and an exact ratio as between metered fuel and metered product can be determined. While the quantity of gas used per KWH varies somewhat from the 27.8 cu. ft. per KWH figure, the B.t.u.'s per KWH, as determined by laboratory test, are very constant. When the July maintenance work had been completed, the engine was thrown into continuous operation again. However, as indicated by the records, it was not operated at full load, but rather at the per cent load necessary to take care of plant requirements, thereby reducing the daily KWH sold to the power company.

Flocculation Studies

The most interesting investigation of the effect of flocculation, without benefit of chemicals, upon the efficiency of sedimentation was conducted for two 30-day periods on raw domestic sewage. Two 50-ft. clarifiers were placed in parallel operation and various constant rates of flow of raw sewage were treated in each clarifier. Clarifier No. 1 carried plain unflocculated sewage, while Clarifier No. 2 received flocculated sewage. Without going into detail on the observations made, it was clearly indicated that at least a 50 per cent advantage in removal of suspended solids was accomplished by flocculation, provided the velocity between flocculator and clarifier was not sufficient to shred the floc. An increase in the rate of flow reduced the advantage of flocculation and at higher velocities and shorter detentions the advantage became increasingly less.

▼

"O-A" Alum Must-a Shrunk It

Typewriters, printers, proofreaders, editors—all make mistakes, or else miss such at times. Concerning the brief announcement and description, in our May issue, of the new plant of Activated Alum Corporation—now producing "more and better" coagulants at Baltimore, Md.—Fred Stuart, president, writes us as follows:

> "You may know, without our saying so, that we appreciate highly the news item on our little plant in your extraordinary Convention Issue. In it, though, there was one error concerning the floor area of the plant. We are just ten times as "big" as you credit us with being—at least in size—the stated 1,600 square feet of area covered being 16,000 feet."

Well, all that we can say is that Mr. Stuart has an apology coming to him. When we visited the plant (as the pictures revealed) the plant was considerably larger than 1,600 feet. All that we can say is that between the taking of notes at the plant and the printing of the description of it, *Fred must'a turned out some "overly-activated" alum that shrunk it!*

▼

$5,000,000 May be Milwaukee's Cost for Activated Sludge Infringement

In a startling decision U. S. District Court's Judge Geiger has recently held that the City of Milwaukee, its Sewerage Commission, and a group of contractors involved, owe Activated Sludge, Inc. almost $5,000,000, as a just settlement of the damage suit brought by the American owners of patent rights on the Activated Sludge process.

In reaching such a decision, the basis is the difference in estimated costs to Milwaukee had it utilized the alternate scheme available at the time (sedimentation and trickling filters) and the cost of construction and operation of the activated sludge plant. This evaluation was brought in by George B. Gascoigne, Cleveland consulting engineer, as expert for the plaintiff company—Activated Sludge, Inc. Two other methods of settlement, offered by others representing the City,—(1) Straight royalty fees; (2) Compensation based on the method of settlement and amounts paid by other cities—were rejected by Judge Geiger, "for the reason that the proofs (of savings involved) submitted under the rule invoked by the plaintiff are found adequate and sufficiently certain."

The savings to Milwaukee, as calculated by the Gascoigne firm, are as follows:

On Construction	$1,826,935
On Operation	775,000
Interest (10.4 yrs. at 4.563%)	868,801
Total on Original plant	$3,471,126
Extensions since	1,235,917
Contractors' profits	270,249
Total Savings	$4,977,292

Interesting is the notice taken and space given the Milwaukee and Chicago suits by "Time," on page 48 of its July 5th issue. Excerpts—"Last week in Milwaukee (these proceedings) brought sewage disposal smack into the dinner table conversation of every taxpayer in the City." . . . "Judge F. A. Geiger—awarded profits and damages of $4,977,000, equivalent to a $6.00 tax increase for every $1,000 of real and personal property value on Milwaukee assessment rolls." . . . "Poignantly for these tax payers, Milwaukee might once have purchased rights to the Activated Sludge patents for $25,000, but preferred to gamble on their validity." Concerning Chicago—"Activated Sludge's compensation in that case (Chicago's) may make Milwaukee's payment look like small change." Settlements already paid Activated Sludge by other cities, held infringers, was stated to be some $630,000 to date, Cleveland, Indianapolis, Houston showing in the highest brackets. Suits now pending are against New York City, Fort Worth, Tex., and about 100 additional cities. (To many, it is relieving to know that all patents on the Activated Sludge process—at least those controlled in the U. S.—have now run their 17 year limit.—Ed.)

BUFFALO CONVENTION OF A.W.W.A. SETS A PACE

Several Records Established at Highly Successful 57th Meeting

IN OUR June issue, which had to be closed during the Buffalo convention of the American Water Works Association, we could only run a brief account outlining the high-lights of this outstanding meeting, with comments on the progress noted in growth, strength, activities and interest in a rejuvenated A. W. W. A.

Some of the high-lights will stand repetition, for the sake of deserved emphasis:

(1) At A. W. W. A.'s 57th Convention, attendance reached an all-time high mark. With 1,140 paid registrations, a record was established for all the years that a registration fee has been collected. The estimated total attendance was between 1,400 and 1,500.

(2) Statistical evidence revealed a record gain in new members (250+) during the first five months of the year. Amongst these were many "new-old" members, who have renewed membership in A. W. W. A. after a period of "watchful waiting," or a temporary depression absence.

(3) The many old and familiar faces which were seen at this 1937 "prosperity-convention" after three to eight years of non-attendance at annual conventions.

(4) The manufacturer's "prosperity-show," involving a record in equipment and materials exhibits, requiring 115 display spaces used by 82 exhibitors.

(5) The coming available of four new reports from the Water Works Practice Committee, ready for discussion and criticism on the floor preparatory to final approval as standard.

(6) The smoothness of the running of the well-oiled convention "machinery" under Secretary Jordan and staff, and by the Committee on Local Arrangements under Alan Drake.*

(7) Entertainment of super-quality, setting a new standard under the master hand of Chairman Wm. J. Orchard, which brought 800 and more to the "All Division Dinner," and better than 1,200 to the closing dinner-dance. The regrettable ringing down of the curtain on Bill Orchard's 12 years of "home-talent" performances by men and women connected with the water supply industry, which have won acclaim for A. W. W. A.'s generous and masterful Chairman of Entertainment. And, this year with his retirement, an award from A. W. W. A.'s Board of Direction and officers, in the form of Honorary Membership in the Association for this and other services rendered. A fitting recognition of the able and energizing member and Director of the Association that he has been.

Eugene F. Dugger, President of A.W.W.A.

Malcolm Pirnie, Heads the Water Works Practice Comm.

W. M. Rapp, New Honorary Member (52 Years in Atlanta's Water Dept.)

Ross L. Dobbin, New Honorary Member. (A Past President and Diven Medalist)

The Convention Opens With a Bang

American Water Works Association's 57th Convention opened with a *bang!* The unusually high percentage of complete registration (for the convention period) which was shown the first day, and the general spirits of those gathered, presaged the sort of convention that it proved to be. It was, at once, a quality as well as a quantity convention. From Mexico and Canada, from the Pacific Coast and the Atlantic, they came to find a rejuvenated association and a convention in keeping. For instance: Six new directors elected during the year, and all six on hand to take office under the new administration headed by Eugene F. Dugger, of Newport News, Va., who says "Things are going to happen in A. W. W. A. during the next 12 months!"—and, says it like he knows what he's talking about, means what he says.

Awards and Honors

On the following were conferred Honorary Memberships:

Thomas Brooks—Sup't of Distribution, Los Angeles, Calif. (For 54 years with the Los Angeles Water Department).

Wm. W. Brush, Editor, "Water Works Engineering," New York, N. Y.

Ross L. Dobbin, Manager Public Utilities, Peterborough, Ont.

Wm. J. Orchard, Gen'l Mgr., Wallace & Tiernan Co., Newark, N. J.

Wm. M. Rapp, Sup't of Distribution, Atlanta, Ga. (For 52 years with the Atlanta Water Dept.; member of A. W. W. A. 38 years).

The John M. Diven Medal—

To: Abel Wolman (Dr. Eng.), of Baltimore, Md. For his valued and outstanding services to the Association over a period of years, reaching far beyond his duties as Editor of the Journal.

*In recognition of such service, Mr. Drake was presented a token of appreciation at the closing dinner.

Clinton L. Inglee, President, Water Works Manufacturer's Assn.

Thomas J. Skinker Heads Plant Management Div.

The John M. Goodell Prize—

To: L. E. Goit and Harry Hayes, Engineers, Los Angeles Water Department. For their interlocking papers, on testing bituminous pipe enamels and their application, presented before the 1936 convention and printed in the September, 1936, issue of the Journal.

The Nicholas S. Hill Cup—

The Franklin Henshaw Cup—

To the Indiana Section went both.

The first is given that section showing the largest percentage gain in members during the year closing. The second, to that section showing the best attended meetings by members as compared to non-members. (For the first time a single section won both awards in a given year.—Ed.)

Officers Elected

Plant Management Division:

Chairman—Thomas J. Skinker, St. Louis, Mo.
Vice Chairman—Thomas L. Amiss, Shreveport, La.
Sec'y-Treas.—E. V. Buchanan, London, Ont.
Directors—Roger W. Esty, Danvers, Mass.; Geo. B. Prindle, Highland Park, Ill.

Water Purification Division:

Chairman—W. W. Wallace, Detroit, Mich.
Vice Chairman—Chas. G. Hyde, Berkeley, Calif.
Sec'y-Treas.—Chas. R. Cox, Albany, N. Y.
Executive Committee—Chas. H. Spaulding,* Springfield, Ill.; Paul Weir,* Atlanta, Ga.

*Members at large serving with the three other officers.

Finance and Accounting Division:

Chairman—Jacob Schwartz, Newark, N. J.
Vice Chairman—M. F. Hoffman, Cincinnati, Ohio.
Sec'y-Treas.—C. J. Alfke, Weehawken, N. J.
Executive Committee—Louis D. Blum,* New York, N. Y.; Hal. F. Smith,* Detroit, Mich.

*Members at large serving with the three other officers.

Our President—Our Host

Wm. W. Hurlbut and A. W. W. A.'s Charming "First Lady." (She Was All Done Up in a Cellophane Rain Cape—a Curio for Los Angeles.) Buffalo's Alan Drake Feels Just This Way About Mrs. Alan—Can You Blame Him?

Water Works Manufacturers' Association:

President—A. Clinton Inglee, National Water Main Cleaning Co.
Vice President—H. W. Ford, Pittsburgh-Des Moines Steel Co.
Secretary—John A. Keinle, Mathieson Alkali Works.
Treasurer—Edgar Buttenheim, American City Magazine.

New Orleans in 1938

The city winning the 1938 Convention was New Orleans—the dates, April 25-28. A close second in the running was Dallas, Texas.

Doing Niagara Falls

Everyone wants to see America's greatest display of "Water's Work," and so to Niagara Falls on Wednesday for an afternoon's outing. Then, dinner and dancing at historic Cataract House (1814), followed by "a trip abroad" to see the Canadian and American Falls spectacularly illuminated.

While golfers were at play on the Niagara Falls Club course others were visiting manufacturing plants, the local Water Works and spots of scenic interest. And, others were across the border buying their limit in Canadian merchandise. The men had a choice of visiting the chlorine plants of the Mathieson Alkali Works and Electro-Bleaching Gas Company; or, the "Aloxite" Plant of Carborundum Company to see diffuser tubes and plates made and tested. Many also visited the novel sewage treatment plant, under construction for Niagara Falls, to provide mechanical filtration and chlorination and centrifugal dewatering of the solids strained out, and incineration.

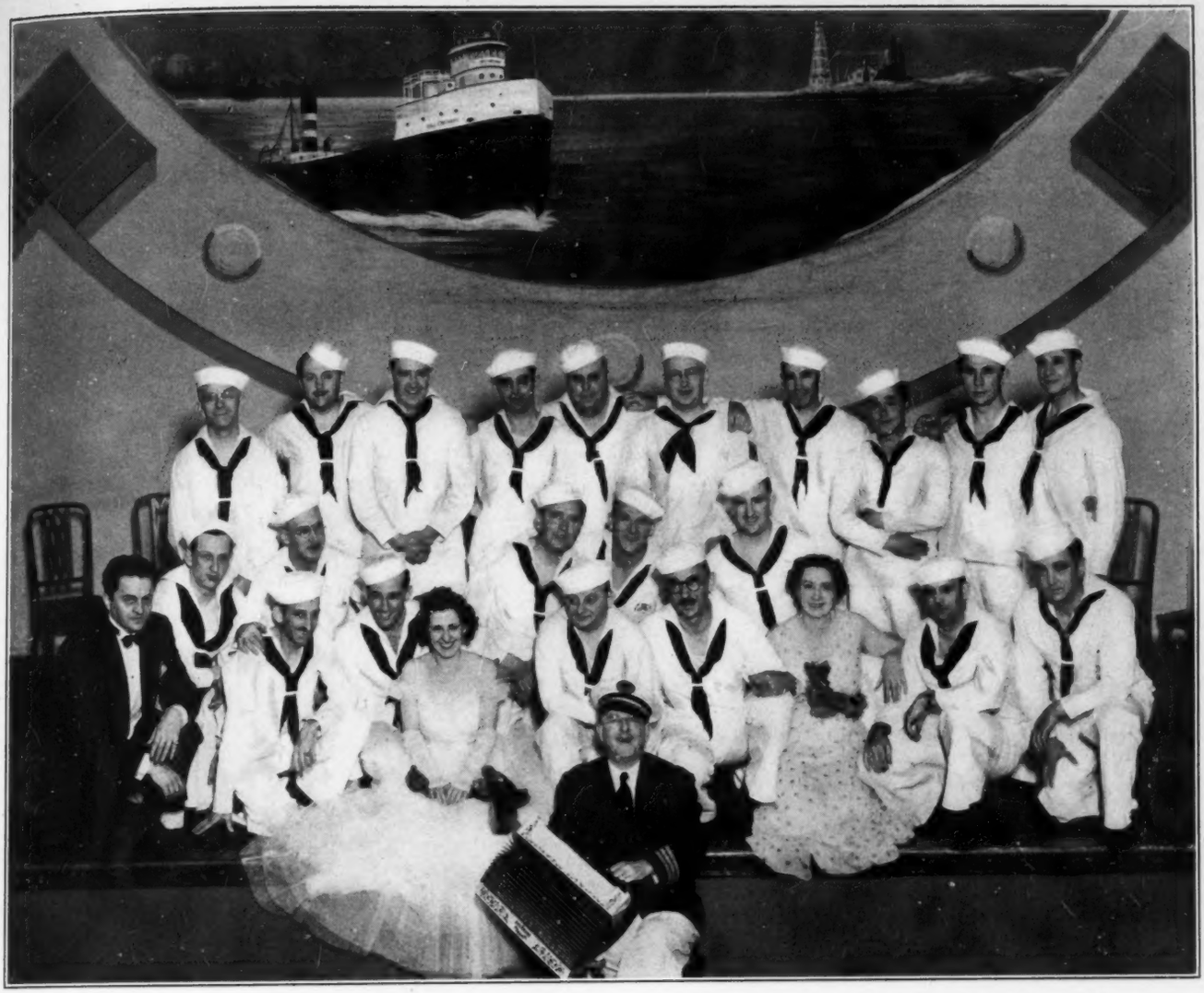
From Los Angeles They Came to Receive Honors

Thomas Brooks, to Be Made an Honorary Member; Lawrence E. Goit and Harry Hayes (Engineers) to Share the Goodell Prize for Their 1936 Convention Papers.

The golf tournament was won by M. LeBosquet, of Chicago, turning in the low-gross score. Top scores in the various classes were Prof. H. N. Lendall (New Brunswick, N. J.); Chas. R. Zesky (Pittsburgh Equitable Meter Co.); Chas. J. Alfke, Manager, Hackensack Water Co. (Sec'y of F. and A. Div.), (Weehawken, N. J.); L. J. Evans (Mueller Co.); Wm. H. Clark, Sup't of Water (Avon, N. Y.).

The Show of Shows

This report would be seriously lacking without a statement concerning the "Show of Shows" which was by all odds the finest of any ever produced by Bill Orchard, who each year has been going himself one better in the "All Division Dinner Show" with casts made up from those connected with the water works industry. It was Bill's farewell show and he and his extraordinary cast



Commodore Orchard, His "Water Boys" and a Couple of "Water Works Sweethearts"

The Cast: From Los Angeles—Ramey, Totten, Sopp, Sloat, Gardener; From Buffalo—Brown, Hamilton, Boyle and Boyle, Grotz, McCarthy, Myers, Yates, Hendler; From New York—Clint Inglee, Geo. Norcom, Jo Wafer, Jack Butler; From Newark—Geo. Haggeter, Ed Reilly; From Pittsburgh—Jo Egolf. The "Sweethearts," Anna Reichl (Guest Artist) and Mary Elva Enslow (Mrs. Linn Enslow). The Accompanist—Allan Parado.

of 22 "Water Boys" and a couple of "Water Works' Sweethearts" deserved all that came their way—see picture.

Joining Commodore Bill's original group of "Water Boys" (Norcom, Inglee, Reilly, Wafer, Butler, Haggeter) came on the "Golden State Four"† (Ramey, Totten, Sopp, Sloat and accompanist Gardner) from the Los Angeles Water Department to share honors with the "gang" from Buffalo's Water Department (Brown, Hamilton, Boyle and Boyle, Grotz, McCarthy, Myers, Yates, Hendler). Completing the cast were sopranos Mary Elva Enslow and Anna Reichl, and pianists Jo Egolf and Allan Parado.

No spot-light was theirs but, behind the scenes and in preparing the show, hard and effectively worked Charlie Eastwood, Bob Browning and Tony Cirino for Orchard and A. W. W. A.

Two Presidents Speak

In his address as the retiring president from an administration passing through reorganization and change, Wm. W. Hurlbut reviewed the notable progress which was being made in all quarters of A. W. W. A.'s activities since the 1936 convention—notably since December 1st, when H. E. Jordan took over the duties of Executive Secretary. He spoke of the many meetings of sections he had attended and was impressed with the new records established in attendance at such meetings during the past year; of the interest in bettering operators' positions and income through increasing attendance at growing numbers of Water Works Schools; the desire for licensing acts to insure job security and better salaries. He stressed the gratitude and significance of the sharp upturn in rate of membership gains since the first of the year, more than making up all depression losses since the 1930 peak in membership. The Association, during the year, had gotten more publicity than ever before, all of which had its value and effect in securing recognition. The production of completed reports from sections of the Water Works Practice Committee was the gratifying result of an energized reorganization. Mr. Hurlbut, feeling that municipally operated water departments should better support the association, sent

†(To Buffalo the "Golden State Four" were sent, in honor of President Bill Hurlbut, by the employees of the Los Angeles Water Dept., who made up a purse of expense money by "passing the hat."—Ed.)

out a plea for municipal participation through the medium of Corporate Memberships. A deficiency noted by the retiring president was the fact that, on the whole, officers of A. W. W. A.'s Sections made too little effort to attend the Annual Conventions. [This year, a noteworthy improvement in this particular was noted.—Ed.]

Addressing the 1,200 members and guests at the closing dinner, in taking over the president's gavel, Virginia's broad-shouldered "Gene" Dugger, in "full steam ahead" tenor, presaged a bright immediate future for A. W. W. A. This, with the wheels now rolling and Harry Jordan in the "driver's seat," following through on policies and plans set up by the General Policy Committee. There was much satisfaction already expressed over the re-awakening of sections of the Water Works Practice Committee as evidenced by the recent turning out of completed reports in tentative form covering specifications of materials, equipment and practices. Therewith, the contemplated production of a much needed revised edition of A. W. W. A.'s Manual for Water Works Practices had been moved up several pegs on the calendar of "business at hand."

As to an insight into what's ahead for A. W. W. A., the water works manager, from the home of battleships and dreadnaughts, outlined several potentialities to be studied in looking toward a stronger organization. Such would seek not only an advancement of the art, but a betterment of the social and economic status of water works men in general, members of A. W. W. A. in particular. Specifically, the last involved the sponsoring of water works schools and the giving of every permissible support to operator licensing movements; efforts toward securing adequate helpful local publicity, seeking a higher appreciation of the local water utility, and those responsible for its operation and service; the founding of more local sections, geographically adequate to reach a greater number of operators, and manned by aggressive secretaries; the establishment of a new and needed grade of membership (possibly a section or affiliate membership) for those desiring affiliation but frequently unable to pay the full membership fee; also, for those who can and do attend sectional meetings with fair regularity but get to A. W. W. A. Annual Conventions only occasionally, if at all.

With a broader base of membership grades and more local sections, reaching a greater number of potential members, and a vigorous and consistent membership campaign in the making, Mr. Dugger foresees an A. W. W. A. with tremendous possibilities in the way of service to a growing membership. Therewith, an organization of ever-increasing strength and voice in quarters where most needed. Of the three virtues *"Faith-Hope-Charity,"* in his taking over, the new president said that he had brought with him the first two. The third, he besought of the members when looking at mistakes he might make, born of good intentions and the failings of mere man.

W. W. Practice Committee Reports

"Report on Transite Pipes," by C. R. KNOWLES, Chairman, Committee 7-T.

The report having been printed in the May Journal in advance of the convention, Mr. Knowles briefly introduced it for discussion and criticism. In reality, the report consists to a large extent of excerpts and conclusions drawn from the voluminous Fire Underwriters' Report released earlier in the year. Mr. Knowles explained the report was based on results of tests made over a period of 12 months at the Waukegan plant of the Johns-Manville Company—many being witnessed by himself and others representing A. W. W. A. Also, into account had been taken experiences of users and the history of installations involving 16,000 miles of laid pipe.

W. D. MOORE, President, American Cast Iron Pipe Co., when invitation to discuss the report was issued, did not mince words in making a direct and forceful criticism of the report, which he pointed out lacked supporting test data needed for an intelligent comparison of certain features of Transite pipe with those of Cast Iron for the same duty. He emphasized the fact that the Underwriters' report, and therefore those parts on which the Journal report was based, was confined to but one class (Class 150) of Transite pipe. To the Committee he wished to offer comparative test data which he had prepared from data taken from the Underwriters' complete report and test specifications for Standard Class "B" (150 lb.) Pit Cast Pipes. Mr. Moore pointed out that there were other tests than the bursting test which had to be considered and he read into the record a summary of findnigs in comparing Transite 150 against Pit Cast Class "B" pipes of 6, 12 and 20 inch diameters in respect to internal pressure rupture (bursting); trench load (crushing) test; beam and bending test. Mr. Moore suggested that it would seem that if specifications, followed for years in producing Cast Iron pipes for 150 lb. pressure, were unnecessarily stringent in comparison with those for Transite pipes for pressures between 100 and 150 lbs., then the water utility industry "had been wasting an awful lot of good material these several years." Since there were existing A. W. W. A. specifications for pipes for 150 lb. he thought it worth considering, as a guide to the uninitiated, to append to the report pertinent specifications heretofore

A.W.W.A.'s Newest Directors Were All Present

(1) *H. A. Dill (Indiana)*; (2) *A. E. Berry (Canadian)*; (3) *J. K. Marquis (Southeastern)*; (4) *M. C. Smith (Virginia)*; (5) *Paul Frisk (North Carolina)*; (6) *A. P. Black (Florida)*.

Jas. J. Salmond, Canadian Section's Oldest Member

A. H. Miller (Sheboygan), New Director, Wisconsin Section

considered standard for the competitive product. Furthermore, that it should be made clear that the report on Transite pipes does not cover the lighter walled Class 100 lb. and Class 50 lb. pipes.

In reply, Mr. Pirnie, speaking as Chairman of the Water Works Practice Committee, explained that the 20 pages of test data on Transite pipe had not been reproduced with the report, principally because of cost. He agreed that there was justification for an appendix which would contain test data in summary form, to allow a comparison between the existing Standard for C.I. pipe and qualities of the newer cement-asbestos pipes.

W. R. CONARD (Burlington, N. J.) called attention to the need for including in the revised report something pertaining to trench load tolerances and trench preparation. Minimum specifications covering material for pipe lines should apply to all materials, if competition was to be worthy of consideration.

In reply, Mr. Knowles stated that the committee proposed to study trench loading and the history of Transite installations next. Since the report dealt with "Transite Pipes," it had not occurred to him to include data on any other material, but agreed that existing standards reproduced would add value to the report and could be incorporated.

"Report on Gate Valves," G. GALE DIXON, Chairman, Committee 7.

Already printed in the Journal, Mr. Pirnie presented the report by title and threw it open for discussion.

FRANK BARBOUR (Boston) felt that in the final report, a coordination of the specifications of the National Fire Protective Association on gates and hydrants with those of A. W. W. A. should be contemplated.

PAT GEAR (Supt. of Water, Holyoke, Mass.) said that it seemed strange that the committee should consist of five engineers and have no long-experienced user of gate valves on it. In his entertaining Irish brogue, Mr. Gear plead guilty to not understanding plans, but when it came to selecting gate valves he had some idea of how it should be done, backed by several years of experience. He was of the opinion that engineers write specifications so engineers will be needed to explain to the superintendent what they mean (laughter). He had gathered from the report that it was drafted in a way to avoid scrapping of any manufacturers' patterns. As one Irishman to another, DENNIS J. O'BRIEN (A. P. Smith Co.) rose to shoot back the thought that "maybe the old patterns were so perfect that the committee could not find a way of improving on them." MR. HEFFERNAN (Milton, Mass.) said that his specification consisted of finding which valve gave the best service on Milton water, then standardizing on that style and make. Replying to "Heffernanian" question, Mr. Gear admitted that he had four makes of valves in Holyoke, and that "valve salesmen had something to do with that" (laughter).

"Report on Fire Hydrants," by W. R. CONARD, Chairman, Committee 7-E.

The already published report was thrown open for discussion. L. E. GOIT (Los Angeles) felt that directions for making flow tests, and taking data, needed clarification. For example, the correct procedure in the determination and interpretation of approach and nozzle discharge velocities should be clarified.

There was quite a little discussion on design to preclude water hammer on closing. In this respect the specifications are seemingly meaningless, inasmuch as the number of stem threads per inch may be significant on one type hydrant (gate type) but far less so on another—the plug type. It was pointed out that the speed of closing only the last few turns was the all-important factor. Further, the length of main was another influencing factor.

"Report on the Laying and Sterilization of Cast Iron Pipes," by WM. C. MABEE, Chairman Committee 7-D.

Copies of the report were distributed, others having been sent in advance to members for criticism. Mr. Mabee briefly reviewed the context and devoted some time to explaining the section covering recommended practices in main sterilization. The two matters creating the greatest discussion and dissension were those of pipe blocking vs. tamping; also, joint leakage tolerances.

Concerning Leakage, THOMAS J. SKINKER, (St. Louis, Mo.) felt that the joint leakage tolerances of 100 gal. per in. of diam. per mile (1,200 gal. per mi. on 12 in. pipe in 24 hours) was about five times too much to allow; thought 20 gal./in./mi. liberal. L. E. GOIT (Los Angeles) said that, even with cement joints, 8 gal./in./mi. was more in line with their experience. R. G. YAXLEY (Waterford, N. Y.) agreed, based on his recent experience of only 100 gal. leakage in 24 hrs. under 90 lbs. pressure on a 10 day old 12 inch line 2 miles long. He explained that 18 ft. compound jointed pipes were involved and, later, a test for 10 hours showed the section to be practically bottle tight.

Concerning Blocking and Back Filling, T. J. SKINKER considered tamping much preferable to blocking — particularly under the smaller pipes. W. W. BRUSH (brought up in the "school of blocking") expressed an opinion that while necessary in some cases of bad trench bottom and preferable to inferior tamping, to his mind good tamping was to be preferred and sluicing (flushing) of solidification was next best. He doubted the wisdom of giving blocking approval, showing it rather as a method to be avoided where possible. J. W. ACKERMAN (Utica, N. Y.) pointed out that sluic-

The "W.W.W.s" (Water Works Weirs)

Victor of St. Louis; Bill of Atlanta; Paul, Also of Atlanta. (None Related Except in Interests and Ability).

ing was O.K. for sandy and gravelly backfill but no good for clay. Blocking did prevent failures due to pipe resting on sharp stones in bad trench; blocking small sizes being less hazardous than the large.

W. M. RAPP (Atlanta Supt.) preferred sluicing, or flushing, making a practice of partly filling trench with water before throwing in backfill. L. E. GOIT (Los Angeles) said that they used a straight edge on trench bottom and practiced sluicing almost exclusively. Tamping, if properly done, required a trench of too costly width. MR. YAXLEY (Waterford, N. Y.), in rocky trench, used blocking of wood, which will give and later rot away, at the same time tamping with clay between blocks. W. D. MOORE (American Cast Iron Pipe Co.) felt that blocking being necessary in certain conditions it could not be eliminated in practice but, since a heavier walled pipe was required in blocking, the practice was more costly. Therefore, he plead for maximum care in determining the necessity, and consideration of better trench preparation and effective tamping, as a means of attaining pipe economy and insurance against failures.

Concerning Main Sterilization, the Chairman said that 85 sanitary engineers and operators had been questionnaired before evolving the following suggested specification—namely, that "The total chlorine dosage applied to the filling-water be 40 to 50 parts per million; the residual chlorine at the end of the section filled be at least 5 parts; that, not less than 3 hrs.' contact be allowed before flushing and placing in service." As to materials and method, the placing of hypochlorites in dry powder form in the pipe lengths, when laid, was the least satisfactory method. Chlorine gas injected with water during filling seemed the best method; direct gas application during filling next; addition of solution of hypochlorite as third most practical and convenient.

The committee was praised for having brought some order out of chaos in main sterilization practices. L. H. ENSLOW commented that it was a much-needed and appreciated piece of work; and although the quantities of chlorine might seem high, the first aim was effectiveness rather than economy on such a small item as cost of material required. The dosages recommended would not prove damaging to materials in the line. He was glad to see the questionable powder method knocked out and he believed the great variance of reported results had been created by this and other imperfect methods, resulting in "spotty," ineffective chlorination. Experiences had shown that the residual chlorine and contact period required was markedly affected by the degree of efficiency in the all-important scouring out by preliminary flushing and cited cases, during recent flood experiences, to show the high value of efficient flushing ahead of sterilization.

The question of contaminated jute and yarn, and such being a breeding ground for b. coli, came up for discussion. Mr. Mabee thought someone would do well to place clean sterilized products on the market. It seemed that Mr. Rapp (Atlanta Supt.) had perfected a good, clean braided yarn of cotton, which Mr. Weir (Atlanta Chemist) was asked to tell about. Later, Mr. Enslow pointed out that the question of bacteria breeding in dead ends in pipe slime and in yarn in place, brought to mind the experience of Mr. Ackerman at Utica, and others, using the ammonia-chlorine process to maintain residual throughout the system. In such cases chemists found little difficulty with the so-called aftergrowths either in main-deposits or slime, or the yarn "incubators" at the joints. Mr. Weir (St. Louis) said that in the future water works might have to consider delivery of an aseptic water to the mains, rather than merely a sterilized product.

Papers and Discussion

"The Water Works of Buffalo," by ALAN D. DRAKE, Director of Water, constituted the opening paper on the program. Therein Mr. Dake presented the high-spots in the interesting history behind Buffalo's water supply system. Looking back, at one time there was the phenomenal pumpage into the mains of 428 gals. per capita per day—much of which proved to be waste, theft and leakage which a Pitometer survey had revealed. The net accomplishment, involving more effective large taker metering, had been a reduction of consumption to the present average of 194 gals. per capita—netting 116 M.G.D. pumpage. From this, one could gather that attempts to invoke universal metering had not met with favor when put to a test. The reason: There appeared no justification in the citizen's minds to curtail usage as long as there was inexhaustible Lake Erie at their front door. Added to this was the fact that pumping costs through mains, found to have far less friction loss (tuberculation) with years of service than commonly found, plus the fact that only moderate pressure was carried on the system, has resulted in a low unit cost for the water served. Mr. Drake explained that Buffalo was one of the earliest cities to maintain a dual system —high pressure for fire duty, and a low head utility system.

Other high spots: In 1915 a new 330 M.G.D. main pumping station and serious intake blockages by frazil ice requiring permanent correction; in 1927, all important mains cleaned to remove accumulated deposits, new 450 M.G.D. filtration plant in service, first booster station and outlying water towers installed; in 1928, epidemic of taste trouble due to industrial phenolic wastes eliminated by use of wastes for coke-quenching, and taste prevention methods in water treatment; in 1935,

At Niagara Falls

(1) The Chairman of Local Arrangements (Drake), the Exec. Secy. (Jordan), and Chairman of Entertainment (Orchard) Hold a Front Porch Conference; (2) Welch (Chicago), Smith (Dallas) Plan "Something or Other"; (3) The New Chairman of Plant Management Div., Tom Skinker Better Not Show This to Mrs. "Tom"—the "Gals" Are Mary Elva Enslow and Domino Carpenter; (4) A. W. W. A.'s "T. Ts." (Transportation Twins) John Warde and Earle Biddle—Going Over They Did Pretty Well, Coming Back a Freight Train Got in the Path of A. W. W. A.'s "Honeymoon Special."

major betterments to storage and distribution system. The last, completed in 1936, had been productive of a material improvement in pressure conditions and service following the installation of three elevated tanks (2,000,000 gal. each) in the North, East, and South outlying districts. Also the clear water storage at the filter plant had been increased from 18 M.G. to 30 M.G. and many physical connections had been made between trunk mains on what formerly were essentially two separate systems, carrying different pressures. Pressure equalization and tank level elevations (pressures) were being controlled through effectively located automatic cone-valves and a telemetering system connecting into all important operating stations. On important mains, flow measuring vaults had been installed for systematic checking. Mr. Drake also referred to the fifteen million dollar sewerage project, under way at Buffalo to provide protection to Buffalo's water supply and, equally so, that of Niagara River municipalities now suffering from Buffalo's pollution, both industrial and domestic. Water works operating costs in 1936 had been $1,700,000; receipts, $2,412,000.

Round Table Session

(W. V. WEIR, Presiding)

Leak Location and Pipe Finding; S. F. NEWKIRK, JR., leader.

Mr. Newkirk briefly outlined recent developments in methods and equipment used in locating main and service leakage and called on E. Shaw Cole, of the Pitometer Company, as the first discussor.

(1) From Charleston, S. C.—Jas. E. Gibson (Past Pres.) and F. B. McDowell; (2) John Campbell (Pittsburgh Engr.) and Jas. Dunwoody (Erie's Supt.); (3) Jo Harper (Pittsburgh Meter) and Jas. Holden (Supt. New Britain, Conn.); (4) L. L. McCollough (Supt. Slipic Rock, Pa.) and C. B. Blauvelt (Water Works and Sewerage); (5) Dave Heffernan (Supt., Milton, Mass.) and Pat. Gear (Supt. Holyoke, Mass.)—Two Old Cronies and Darned Good "Supers" from New England.

MR. COLE: In noting the present trend of interest in detecting and eliminating leaks from systems, and recent developments of sensitive instruments for measuring amplified vibrations set up on water pipes, by water issuing through leaks, had much to say concerning the weakness and questionable reliability of methods depending on identifying and measuring water leak sound-vibrations. In experienced hands, and with the trained ear of the operator, the sound meter used as an aid by his company, at times, had proved a help. He did not consider that a method depending upon the human ear could be held reliable; leaks of various magnitude, because of variables, had no identifying vibration; fallacious, too, was the belief that foreign vibrations (not caused by leaks) could be filtered out. It was Mr. Cole's contention, based on Pitometer Company's experience, that instruments depending upon vibration detection and evaluation may well be proven of little value unless taking flow measurements also.

H. E. BECKWITH (Pitometer Co. Engineer) commented that the least important phase of a leakage survey, as made by his firm, was the block-by-block leak detection. Before running down minor leaks, the more important losses such as water stealing, lack of pumping efficiency, major leaks, were revealed and eliminated. He pictured the use of leak-detectors in the light of fishing. It seemed to him a question of wasting "bait" on small fry when there were worthwhile "leak-fish" to be taken in short order with one "haul" of the Pitometer survey "drag-net"—so to speak.

F. B. NELSON (N. Y. Department of Water Supply) concurred with what Messrs. Cole and Beckwith had stated. New York's results with the aquaphone method had been useful but required the all-important human ear of ability to differentiate sounds. It could not be compared to the flow-test method.

H. C. NUTTING (Cincinnati, Ohio) differentiated between types of vibration instruments, the most accurate and sensitive being the radio type. With such, he presented some definite experiences, citing marked successes in locating important leakage in a brief period.

J. A. CARR (Ridgewood, N. J.), speaking as a superintendent, said he was especially interested in instruments which the water operator could use himself without involved preparation. In a recent experience in Ridgewood, a great difference in the ability of the geophone and one of the new radio type instruments had been demonstrated effectively. Trials with the former had given confusing indications and missed the leak. Then, putting the test on the new radio instrument, the leak had been found within 6 inches of the spot which had been double checked by the new style leak detector. Equally impressive had been the fact that the mapped location of the pipe was proven erroneous, the argument ending when found where the detector and pipe locator indicated. He had also used the dip-needle effectively in simple location work. In proving service leaks and waste on customer premises, the recording meter had been a valuable ally.

THOMAS J. SKINKER (Sup't, St. Louis, Mo.), speaking from experience, agreed as to the value of flow surveys involving Pitometer measurements. But, he had found the radio leak detector also had its place, agreeing that results improved with experience in the use of such equipment. Preferably, he would have a young engineer operate it. Less complicated and costly, but less definite, was the simpler aquaphone or geophone.

J. W. ACKERMAN (Engr.-Manager, Utica Water Co., N. Y.) had found the new radio locator capable of spotting accurately a service 10 ft. deep—something that other less delicate equipment had not been able to definitely establish.

D. W. GROSS (Chief Engr., Denver Water Comm.) commented on the importance of watching sewage flows at night to spot major hidden leaks. In Denver on various sewers the normal minimum depth of flow (after midnight), had been recorded. Checking such at intervals, or whenever leakage might be indicated from night water flows, had proved useful in not alone detecting leakage but such could be located by back-tracing the flow up the branch sewers to the approximate spot of the leak. Cooperation between water works and sewer departments was therefore valuable to both.

"Operating Gate Valves at Fixed Periods"; leader, J. S. DUNWOODY, Sup't Water Department, Erie, Penna.

Based on experience, Mr. Dunwoody introduced the

J. E. Phillips (Los Angeles) (A Splendid and Interesting Paper). Jas. S. Dunwoody (Erie, Pa.), Round Table Topic Leader.

topic by advocating operation and inspection of valves 16 inch and larger every 6 months; smaller valves yearly. Regardless of size, all of the most important valves warrant monthly operation tests. Valves 12 inch and larger should be in manhole vaults; for 4 and 6 inch sizes valve boxes seemed satisfactory. It was of high importance to see that leaking boxes did not allow dirt and grit to drip onto the stem and stuffing box. Raising and lowering the gate several times should be done cautiously to minimize disturbance of deposits and production of dirty water. Valve operation, in testing or maintenance work, was too important a matter to be done except under the immediate supervision of a foreman to insure effective work and the job being left with valve in open position.

L. E. GOIT, citing Los Angeles practice, stated that all down-town valves were test-operated monthly; all trunk valves quarterly. All valves above 12 inch were equipped with bypasses. WM. RAPP stated that Atlanta's valve operation reports disclosed number of turns required to close and to open. These were checked against permanent office records on each valve, to insure that valves had closed and opened completely. All valves 16 in. and larger were by-pass equipped. H. A. DILL cited Richmond, Ind., practice of tagging every valve with a stamped disc of aluminum to reveal size, direction of opening, number of turns to full open position. T. J. SKINKER, citing St. Louis practice and experiences with frozen valves, was of the opinion that even 6 inch valves should be placed in vaults. It was their practice to stamp box covers "Separating," "Private," etc., to indicate the function of the valve. A member (name not available) added that systematic and periodic fire-flow tests had uncovered closed or partly closed valves. He advocated such tests as a useful check against the closed valve and obstruction hazard.

"Repairing Pipe and Joint Leaks"; leader, THOS. J. SKINKER, Engr. in Charge of Distribution, St. Louis, Mo.

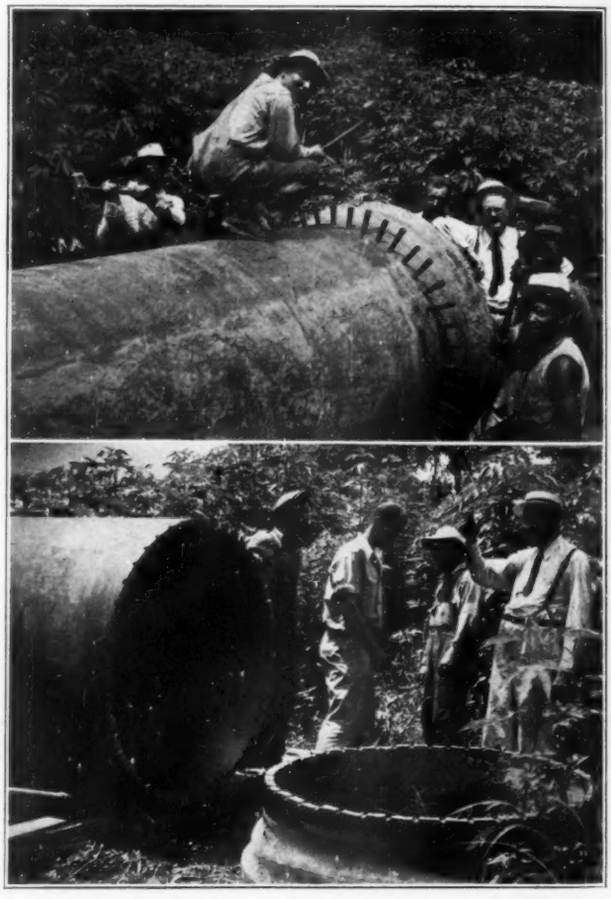
Mr. Skinker briefly outlined St. Louis' experience in electric welding of pits and the use of tapered steel pins (known as "P-Ks") for repairing steel mains.

Asked for Los Angeles' experience, L. E. GOIT also spoke highly of the usefulness of "P-Ks," and also of a tapered screw for repairing pit hole leaks. Electric welding was also practiced. In considerably pitted areas sleeves 3 to 5 feet long were used. Cement grout was forced in, to fill the space between sleeve and pipe, through grout holes at each end. Short sleeves were caulked in place with dry cement mortar.

J. WALTER ACKERMAN cited recent experiences involving the use of a portable "Homelite" generator set and drill for cutting out a section of main to set a Sparling meter into the line. The job had been remarkably simple and economically done.

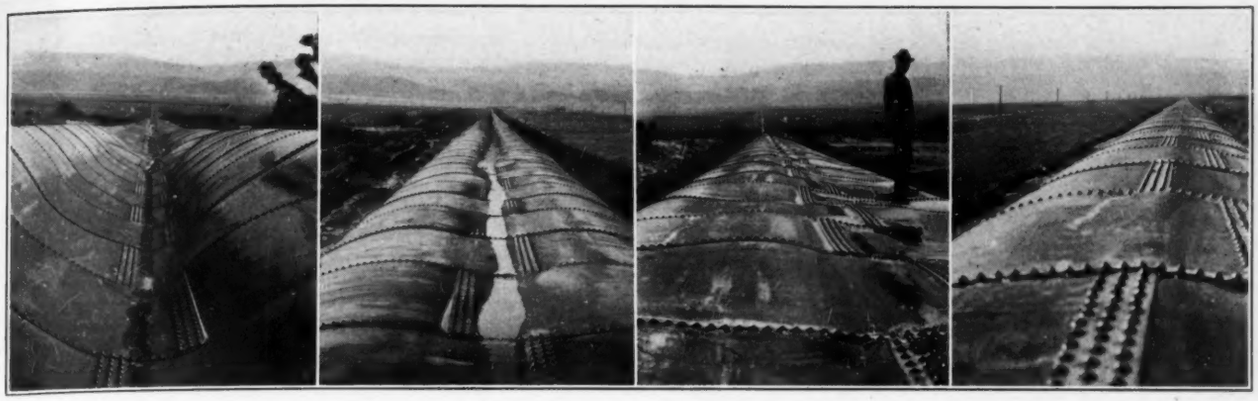
WM. M. RAPP, called on to tell of a method of cutting Cast Iron pipe developed by him in Atlanta, exhibited photographs picturing the unique procedure. It involves compressed air drilling of a line of holes completely circling the pipe. Several round wedges (with two opposite sides flat) are inserted in the holes and driven home by buck-niggers on the end of sledge-hammers running the "gamut" of wedges in place. The pipe splits from hole to hole, just as the drilling operation proceeds around the circumference. In the same manner a circular or rectangular section can be split out of large Cast Iron pipes—neatly, more simply, less expensively, than by other methods.

R. G. YAXLEY, in giving main repair experiences at Waterford, N. Y., said that the section of main was dewatered before cutting by pumping out through a hydrant to keep the trench as dry as possible. L. H. ENSLOW, in going Mr. Yaxley one better, referred to the ingenious dewatering scheme utilized in Danvers, Mass., wherein a portable air compressor connected to one hydrant blew the water out of the section of main through another hydrant, leaving little or no water to drain into the trench when cutting the main. (The method is described and pictured by Esty and Boardman, of Danvers, in the Reference and Data Section of the May, 1937, issue of WATER WORKS & SEWERAGE. —Ed.)



Pipe Cutting by the Rapp-Atlanta Method

(Upper)—Pin-Wedges Set and Ready to Be Driven Home. (Lower)—The Cut Completed, Note the Even Break. (Says Inspector Rapp (with a Wave of the Hand), "There You Are, Boys.")



Following Complete Collapse, Due to Vacuum, a 3-Mile Section of Los Angeles Aqueduct Undergoing Recovery to Original Shape Under 150-Ft. Head. (Described by Phillips, This Report).

The Los Angeles Aqueduct

"Twenty-five Years' Operation of the Los Angeles Aqueduct" was interestingly high-lighted, as to history and operating experiences, by J. E. PHILLIPS, Engineer in Charge of Aqueducts, Los Angeles Dept. of Water and Power, who lauded the vision and ability of the late William Mulholland who had conceived, designed and built this 150 mile life sustaining artery through mountain and, in steel pipe, across canyon after canyon of California's desert. This, that the Pueblo of Los Angeles might become the metropolis that it is today.

With the benefit of numerous well-selected lantern slides, Mr. Phillips, in a talking review, found his audience eager for more when he had already over-run his allotted time on the program. Some of the high spots were the following. Because of marked differences in day and night temperatures, the serpent-like 10 foot diameter steel aqueduct literally crawls over the desert if left empty. The famous riveted-plate Jaw Bone Siphon; under 800 feet of head at the bottom of the canyon has a wall thickness of 1⅛ inches. Almost as spectacular was the siphon crossing of Pine Tree Canyon. At other points the pipe walls are so thin (¼ in. plate for 100 ft. head) that the aqueduct walls literally "breathe"—this condition, after 25 years, having actually produced some fatigue cracks where pitting of the steel had been most pronounced.

The most thrilling episode in the history of the aqueduct involved the 1913 collapse of 3 miles of pipe crossing Antelope Valley. When a cloudburst washed out a section, 14 feet of vacuum completely collapsed the aqueduct. To most, it looked to be a ruined pipe line, but not so to Mulholland. Reasoning that if 14 pounds of vacuum could suck it in, 150 ft. of head should push it out again, the "Chief" (Mulholland) ordered the water turned in. Slowly, but surely, the pipe walls began to push out, after awhile becoming flat and wavy on top. At the end of the week (under 150 ft. head) it merely looked a bit wrinkled with remarkably few leaks resulting at the riveted seams. The most exciting episode was that of the wrecking of sections of the aqueduct by Owen's Valley dynamiters, the most serious being when 450 ft. of the vital 9.5 ft. No-Name Siphon was blown out, with the expectation of putting the aqueduct out of service for several months. Surprised were the wreckers to find the section rebuilt in just 14 days. During this period of war there was ample excitement in Los Angeles, and many nights of worry to the heads of the Water Department.

Concerning service dependability of the aqueduct, Mr. Phillips said that, including the collapse, the dynamiting, inspection and repairs, the aqueduct had been out of service but 9.6 per cent of the time since 1920. Amongst the reasons was the fact that the open sections (40 miles being side hill canal) had been blocked by mud and debris washed in during cloud bursts, even though many overhead storm flow crossings (wide troughs) had been provided where thought most needed. He felt that the open sections had constituted the chief weakness of the system. Ice had damaged the sloping concrete walls so much as to require expensive reconstruction at several points. Along the canal banks oil spray had been effective in minimizing erosion and controlling weed and willow growths—the same treatment being given reservoir banks. Rough bottom, wavy-walls, sharp bends in the tunnel section had been responsible for unnecessary friction losses. Resurfacing 60 miles of bottom and smoothing of the walls had already raised the aqueduct capacity to 505 sec./ft. As to the condition of the steel pipe: when installed, a life of 30 years was estimated. Now, after 25 years, some of the ¼ in. wall pipe would probably have to be replaced or lined within 5 or 6 years, but the majority appeared good for 15 years longer at least. Some light wall sections with deepest pits (some 3/32 in.) had been cleaned and coated with bituminous enamel. Since elimination of carbon-dioxide entry into a tunnel the corrosion rate was expected to be reduced.

In reply to questions, Mr. Phillips said that the oil used on the banks was a distillate, had given no taste troubles, killed willows by reaching the roots. Tem-

One Result of Los Angeles—Dynamiters' Efforts on Vital "No-Name Siphon."

perature extremes across the desert went from 15 below zero to 120 above in the shade. Seepage from alkali soil had not been the cause of concrete slab disintegration. The steel section had been designed for 430 sec. ft. with C=90 predicted after 30 years' service. After 25 years "C" actually was between 100 and 105 at 500 to 600 sec. ft. delivery.

Licensing and Pensioning

So important does A.W.W.A. consider matters pertaining to operator advancement and security that it devoted practically an entire session to a discussion of licensing, retirement and pensioning of water works operators.

In charge of the symposium on **"Licensing of Water Works Employees"** was PROFESSOR LEWIS V. CARPENTER, Chairman of Committee on Short Schools and Licensing, who introduced the topic by referring to the resolution of A.W.W.A's Board of Directors endorsing and encouraging "licensing, certification, or some form of regulation of water plant operators and supervisors as a means of preventing the employment of incompetent personnel and assuring some continuity of employment of efficient personnel." Professor Carpenter then reviewed accomplishments with voluntary certification systems such as that established in Texas and productive of noteworthy results; more recently, in Georgia and California and contemplated in South Carolina. As to states with legal licensing, New York was the most recent to pass a licensing act which became effective July 1st, regulations being drawn by the State Department of Health. A licensing act for Wisconsin was unfavorably reported out by Committee on the grounds that "the measure would interfere with the prerogative of municipal officials in hiring and firing employees," Strange as that may seem," commented Carpenter. However, licensing of certification now exists in nine states (California, Georgia, Michigan, New Jersey, New York, Ohio, South Carolina, Texas, West Virginia) and interest in licensing has been rapidly increasing in others.

Professor Carpenter was of the opinion that almost every State Department of Health is already legally able to set up a system of certification insofar as operators of purification plants are concerned. If the majority of operators wished it, only a petition to the Department of Health seemed necessary. As a guide in drafting a licensing bill, and regulations, Professor Carpenter outlined several advantageous basic features which experience has taught to be desirable. (Too lengthy for presentation here—the assistance of A.W.W.A.'s Committee on Licensing and copy of its recommendations are available to anyone interested sufficiently to request them.—Ed.) It was Professor Carpenter's opinion that the first bill should be as simple as possible and later amended or strengthened if need be—leaving details to be covered in the regulations.

Reporting on "The Texas Volunteer System," Professor Carpenter said that 400 certificates had been issued, the operator being required to obtain a "Grade C" license first and thereafter "Grade B" and "Grade A" as rapidly as qualifications, justified the promotions. The lower grade could be held not more than 3 years, thus requiring preparation during that period for the higher grades.

"Experiences in Michigan" were reported by COL. E. B. RICH, Chief Engr., Michigan Department of Health. Without a specific law, licensing regulations had been set up under authority of the Michigan Health Code and applied to privately as well as publicly operated plants. Results: Enhanced respect for the Water Department by municipal officials; improved operation with advanced pay and fewer changes in operating personnel; higher public interest in the plant; the attraction to higher grade operators and improved salaries; absence of complaints from operators or plant managers.

"Experiences in New Jersey" were covered by CHAS. H. CAPEN, JR., of the North Jersey Water Supply District, who reviewed the effect of New Jersey's Licensing Law of 1918—since which time 356 water operators and 616 sewage operators had been licensed. As of today, with a total of 272 active licensed operators, 25 per cent are first class operators and 18 per cent are college graduates, but the State Department of Health has found that men with a high school education and experience have been just as successful applicants as have college graduates with the minimum experience required. The New Jersey law, having been tested through the courts, had been declared valid. Unfortunately, once licensed in New Jersey always licensed, because there was no method of revoking inactive licenses or requiring re-examination or periodic renewals. To secure an amendment, requiring periodic license renewals and to provide better security in the matter of tenure of office, attempts are being made to correct these two most serious defects in the New Jersey law.

"California Experiences" were presented by R. F. GOUDEY, of the Los Angeles Water Department, who has been very active in introducing the voluntary system of licensing sponsored by the California Section of A.W.W.A. Mr. Goudey reported 110 licenses issued in grades 1-2-3 to operators serving 56 cities representing 95 per cent of California's urban population. Such licenses were considered probationary, since written examinations had to be passed within a time limit by those applying for permanent certificates. Working in cooperation, a short-school for operators was being given by the University of Southern California, issuing a certificate in "Water Treatment Plant Administration." (Mr. Goudey, incidentally, is in charge of these short courses for water works and sewerage operators.—Ed.) Too early to evaluate results, Mr. Goudey stated, however, that the scheme has pepped up operators and increased their interest in the school, in certification and advancement.

"Husbands and Wives"

(1) *Mr. and Mrs. Bill Sherwood (Boston);* (2) *Mr. and Mrs. John Winder (Dallas);* (3) *The Fred Stuarts Arrive in Their "Floating Laboratory Trailer";* (4) *The Bob. Haywoods (Easton, Pa.)* (5) *Prof. and Mrs. Lewis Carpenter (New York University).*

R. G. Yaxley, Supt. Water, Waterford, N. Y. C. A. Holmquist, Chief, New York State Dept. Sanitation. T. L. Amis, Supt. Water and Sewage, Shreveport, La. (Elected Vice-Chairman Plant Management Div.)

At this point, C. A. HOLMQUIST, Chief Engineer, New York Department of Health, briefly outlined New York's recently passed licensing act which authorizes drafting of regulations and qualifications by the Public Health Council. Two requirements were named—(a) Chlorinating systems serving 40,000 population and upwards would be required to employ a Class 1 operator; (b) Activated Sludge plants, regardless of size, would have to be manned by Class 1 operators.

H. E. MOSES (Penna. Dept. Health), stating that private water companies blocked licensing in Pennsylvania—asked for requirements in other states. To him, F. H. WARING replied that the new law in Ohio, which applied to all classes of plants, was drawn after careful scrutiny of all existing licensing laws for the best features of each. Professor Carpenter explained that the New York law in its present form exempted privately owned plants. C. H. CAPEN said that the New Jersey law applied to private plants. However, tenure of employment and fee collection could not be enforced and water companies had given good cooperation. PAUL WEIR cited the desire of Georgia operators for licensing, as evidenced by short school attendance of better than 200 in 1936 compared to 35 at the first school. Now, with voluntary certification and progressive advancement, they looked toward legalization of licensing when the time was right for it.

L. H. ENSLOW, in commenting on the excuse given for the killing of Wisconsin's licensing bill, stated that it hardly held water. Licensing did not stop a municipality or private company from replacing an employee. All that the law was designed to do, or could do, was to prevent a replacement involving a man not qualified under the license act to become an operator—plumbers and politicians. Whereas, the act might interfere with "prerogatives" to fire and hire, it did not interfere with the *rights* to replace one licensee with another of equal rating.

"The Retirement and Pensioning of Water Works Employees"

(a) **"Effects of Federal Legislation There-on"** were discussed by DALE L. MAFFITT, General Manager, Water Works, Des Moines, Iowa.

MR. MAFFITT (Chairman of Committee on Social Security Legislation), reviewed the status of and analyzed the plan of Federal old age security and unemployment insurance acts recently passed; but, unfortunately, of no avail to municipal and governmental employees. Since this was the case, there had been a growing realization of the need for old age security and pensioning systems for municipal employees, resulting in movements in this direction in many states. Managers of water works would be expected in the future to take account of depreciation of man-power just as is done in the case of equipment which is subject to wearing out or retirement because of age or obsolescence. Public sentiment had turned to favoring retirement and security plans and it seemed timely for municipalities to set up such a plan for water works employees which at least will equal the benefits accruing through the Federal act, and employment in private enterprise. Here was a problem to which water works executives should be expected to give their immediate attention while public sentiment was most favorable. Furthermore, the average water works employee deserved such consideration just as much as members of police and fire departments, who have been benefiting from pension plans for years.

(b) **"Municipal Activity on Retirement and Pensioning"** was presented by LEON A. SMITH, Supt., Water Works, Madison, Wis.

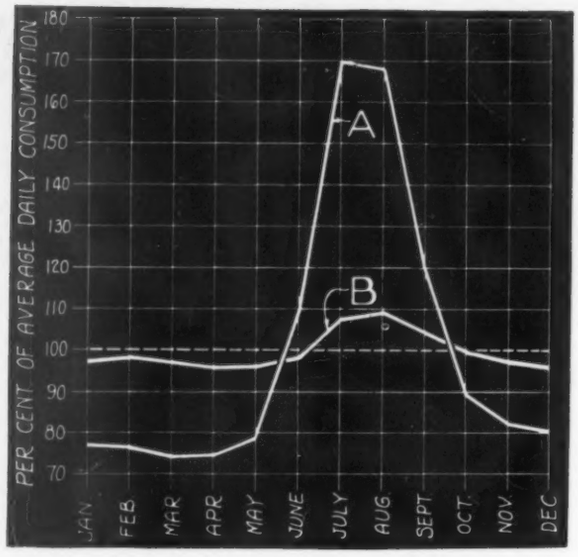
Mr. Smith's contribution was in the nature of a reply to the question and challenge delivered by Mr. Maffitt. In it he outlined features of the recently established retirement plan, for the benefit of employees of the Madison Water Department—something he had been working on for 10 years.

The plan calls for retirement pension in monthly payments amounting to 50 per cent of the employees' average earnings during the final 20 years of service. For this purpose deductions from employees' wages were to be matched by Water Department contributions to the pension fund. Over a 25 year period the deductions would average 2.5 per cent of the earned wage. Men working for the department less than 25 years would be taken care of by purchasing the employees' benefits elsewhere accumulated. In case of resignation, or death, the employee's part of the impounded fund was subject to payment to employees or estate with accrued interest. In retirement, the employee had elective options given the holder of an ordinary annuity. Life insurance on the group plan had been considered but the idea dropped because of inequitable costs. Men already over the 65 year retirement age will be taken care of in retirement jobs. The plan would add 7 per cent to the Water Department payroll in the beginning (to take care of the oldest employees) and required 4 per cent of the total income of the department. With the passing of years the 7 per cent gradually reduced to 2.5 per cent in the 25th years and thereafter.

D. A. HEFFERMAN (Supt. of Water, Milton, Mass.), stated that Massachusetts now had an optional pension plan for all cities of populations above 11,000 which had voted to accept the new contributory retirement

Loran D. Gayton (Chicago) (to Him a Vote of Thanks for His Study of Water Consumption as Affected by Air-Conditioning)

Wm. C. Mabee (Indianapolis) (to Him High Appreciation for His Committee Report on the Laying of Cast Iron Pipe and Sterilization of Mains)



Chicago Curves Comparing Water Demand Ratios. A—Air Conditioned Premises (avg. consd. = 7.66 M.G.D.). B—Non-Conditioned Premises—(avg. consd. = 12.45 M. G. D.) (See Gayton This Report.)

system for municipal employees—Milton being one. The scheme was very similar to that of Madison, the city matching the employees' contributions. Employees earning $50 or less per week paid in 5 per cent of their wage, the employee's accumulation (not the city's part) being subject to return with 3 per cent compound interest upon discharge or resignation. Present employees had the privilege of not accepting the plan, but it would be compulsory with all new employees. Employees have the option of retiring at age 60, must retire at age 70. The system gives the employee much greater insurance coverage than he could purchase as an individual at the same cost to him. In this were benefits in the form of old age pension, disability retirement, death benefits. In the beginning the city's contribution would amount to 6 per cent of the wages of those entering the system. The fund would be managed by a three member board operating under savings bank laws.

At Niagara Falls Historic Cataract House—1814

(1) *A Golf Foursome in the Garden (Col. Jo. Wrench Said It Was Tea They Were Having);* (2) *A Corner of the Veranda to Which Rain Drove the Diners;* (3) *History Repeats—and Cataract House Has a New Sign;* (4) *The Corydons, Harpers and Some We Cannot Identify;* (5) *Wallace and Tiernan's Bob Browning and Charlie Eastwood, Property Man and Stage Manager for Bill Orchard's Last and Best Show. With Them is Fred Stuart, Lately of "Activated Alum" Fame.*

Water Usage in Air Conditioning

"Records of Actual Use of Water for Air Conditioning," presented and discussed by LORAN D. GAYTON, City Engineer, Chicago, definitely represented the most concrete statistical information of actual water usage yet produced by a water utility, and therefore highly valuable. (Mr. Gayton's contribution has since appeared in full in the June issue of the Journal of A.W.W.A., and illustrated graphically. For the reader's benefit, however, the Chicago findings will be briefly reviewed here.—Ed.) With the lake to draw upon, lack of water was not Chicago's problem in air conditioning whereas surcharging of sewers, inadequate to take away the spent water, had proved a real problem. With water at 6.8 cents per thousand its low cost was against conservation practice by air conditioners. In order to look into probable demands on the water system in the future, when air conditioning has reached the expected saturation point, a planned consumption survey of air conditioned premises in the Loop District had been made. Involved were 700 flow records, used in preparing 5 study charts which revealed the following:

During July and August (maximum demand months for air conditioning) consumption rose to 130 per cent of the average for the year for the entire Loop District. For air conditioned premises alone 170 per cent of the annual averages; for non-conditioned only 110 per cent. In the theater and hotel district maximum reached 250 per cent of average. Air conditioning increase (1936 installed tonnage of refrigeration capacity) had increased 35.5 per cent over 1935; water demand by 38 per cent. In checking water demand by the water to waste (non-evaporative) system of cooling the figure presented before A.W.W.A., by L. L. Lewis of the Carrier Company (2 gals. per minute per ton of refrigeration) had been found a safe one because it proved to be the requirement under 100 per cent capacity operation. Actual findings, on 7,854 tons' refrigeration capacity (398 installations) surveyed, proved to be 1.54 gal./min. when operating at 77 per cent capacity. To the water utility the most significant findings, however, related to the peak water demand which had reached 250 per cent of the daily average in the most nearly completely air cooled zone—that of hotels, restaurants and theaters. The studies in Chicago were to continue with some efforts in encouraging water conservation as conditioning installations increase.

"Recorded Use of Water for Air Conditioning," by O. C. HOLLERAN, Industrial Marketing Specialist, Bureau of Commerce, Washington, D. C.

Mr. Holleran reported on a survey just completed by the Bureau of Commerce, which was designed to secure information pertaining to water supply and air conditioning. He commented on the meager amount of concrete information on this rapidly developing problem, which could be supplied by water works managers. In the cities of more than 100,000 population surveyed only six managers, out of 38, were in a position to state the number and type of air conditioning installations and the water requirements of each. A matter hampering the gathering of information was the fact that in most cities permits for air conditioning installations were issued by departments other than the Water Department. To him this seemed to be a decided weakness and questionable split authority. Some important cities (Dallas, Atlanta, St. Paul included) the survey showed, had already reached the capacity of their water supply facilities and could not offer water to addi-

tional air-conditioning customers. Others were taxed only between 75 and 95 per cent of capacity—notably Pittsburgh, Hartford, Philadelphia. In these cities the lack of information, and no plans to make possible the extension of comfort giving air-conditioning, was especially unfortunate. Without the needed essential facts any estimate of water use by air-conditioning must be purely guess-work which may place the water service in an embarrassing situation, especially if the authorities should limit the use of air-conditioning equipment, now so much in demand, without ample grounds for so doing and without making efforts to properly evaluate and meet such demands. Since practically all authorities agreed that the problem was becoming serious, Mr. Holleran urged water authorities to make the needed survey and get information before too late. Since the waste-water disposal problem was one of concern to the sewerage authority, water and sewer authorities should work hand in glove. In reply to questions, Mr. Holleran said that air conditioning for the average home would require between 10 and 20 gals. per minute depending upon location and water temperature.

L. A. GEUPEL (City Engr., Evansville, Ind.), said that the city was amply equipped to supply air-conditioning demands and could make good use of the revenue in paying for new ample sewers. Unfortunately the supply (Ohio River) was 85 degree water and air-conditioners had gone to wells 85 ft. deep yielding 60 degree water. Mr. Gayton commented that ground water in the Chicago area was out of the question, because the present rate of 6 ft. lowering of ground water level annually had forced industry to come to the city for more water each year.

A. H. MILLER (Supt. Water, Sheboygan, Wis.), was of the opinion that revision of rates would be necessary to finance additional facilities to meet seasonal demands for air conditioning. And, L. R. Howson suggested that a "slide-up" rather than a "slide-down" rate might be considered as a practical means of encouraging conservation in water usage. Mr. Gayton added that the Chicago Water Department was cooperating with the Chicago Edison Co. in evaluating additional current costs as against the heavier use of cooling water in refrigeration equipment operation.

CHAS. B. BURDICK (Chicago Consulting Engineer), recalling the fact that the net cost of water, in general, was a combination of 50 per cent operating charges and 50 per cent fixed charges. In cases where seasonal demands required greater investment in equipment the fixed charge increase always necessitated a revision. Dependence on ground water supply had not appeared the practical solution, nor the least costly; and, disposal of the spent water was another problem. Therefore, taking all angles into consideration it was generally conceded that water reuse (recirculation) in evaporative cooling systems must be looked to as the most practical and the ultimate solution. To encourage such practice regulations pertaining to installations, and probably some rate revisions, would seemingly become a necessity.

W. V. WEIR (Manager, St. Louis County Water Co.), stated that air-conditioning load added to the sprinkling load had created a serious situation on his system. Having ample supply the critical matter was the 85 degree water, requiring more of it, and thereby large distribution main loading. They were trying a solution involving reduced rates for off-peak consumption. This required the taker to draw water between 9 p. m. and 6 a. m. for storage on his premises in elevated tanks, or ground tanks with repumpage as required. Flow recorders had been put on such services as a check on hours of taking.

THOS. J. SKINKER commented on the numerous small installations of so-called air conditioning units in St. Louis. The use of water had been high and the inadequacy of old ⅝ in. services to supply the pressure and flow, plus unexpectedly high water bills, had resulted in numerous complaints against water utility and the manufacturer or agency installing the equipment.

A "Water Renting" Proposal

Mr. Gayton, at this point, told of a proposed scheme, advanced to him, which involved what might be termed "water renting." In brief, the city would meter to the air-conditioner his cooling water requirement at nominal rates through what might be termed a heat absorbing bypass. The water would pass from the main through the air-conditioning equipment back into the main through an assumedly closed system. The water, plus absorbed heat units, would be returned to the city's mains through a booster pump in the "bypass main." This all might sound rather plausible on first thought, but rather fanciful on second consideration. Overlooking what might happen in the way of temperature boosting and possible refrigerant and oil leakage into the "rented-water," the present effort of health and water authorities to eliminate hazards due to cross connections-made such a scheme seem hardly compatible.

Mr. Holleran, in a parting word, warned water utility and water department managers against doing anything, possible to avoid, which would deprive the public of its desire for "comfortizing" and air-conditioning. To avoid criticism or revolt against the water works and its management it seemed necessary to realize that a popular demand on a public utility has to be met. The water requirement problem was plainly on the door-step of each local water utility and the water works profession on the whole, for the most equitable and least painful solution.

(*This Report Will Be Concluded in Our August Issue*)

▼

Abel Wolman to Head Sanitary Engineering at Hopkins

Having but recently conferred on him the honorary degree of Doctor of Engineering, Johns Hopkins University has secured this brilliant alumnus—Abel Wolman—to head its Department of Sanitary Engineering, the appointment becoming effective September 1, 1937.

Abel Wolman was a member of the first class to be graduated from Johns Hopkins' School of Engineering 25 years ago. Ever since his graduation he has been connected with the Sanitary Engineering Division of the Maryland Department of Health. His rise to the position of Chief Engineer, which he has held for several years, was rapid and deserving. In addition he is P.W.A.'s director for Maryland and Delaware; Chairman of the Committee on Water Resources for the Federal government; Chairman of the Maryland State Planning Commission and holds other positions besides. With his going to Johns Hopkins he expects to relinquish some of these many duties, we are advised.

In this same issue is a recounting of the most recent honor conferred on Wolman—the John M. Diven Medal of the American Water Works Association, "for outstanding services rendered the Association."

HARRISON P. EDDY

(1870—1937)

Harrison Prescott Eddy, dean of the sanitary engineering profession in the United States and senior partner of the consulting engineering firm of Metcalf & Eddy, died suddenly in his 67th year while in Montreal on June 15, 1937. In a few hours he was to have delivered an address as a newly elected honorary member of The Engineering Institute of Canada.

Mr. Eddy was born in Millbury, Mass., April 29, 1870. His scientific education was received at the Worcester Polytechnic Institute, from which he was graduated in 1891 with the degree of Bachelor of Science. In 1930 the Institute conferred upon him the honorary degree of Doctor of Engineering, as did Northeastern University in 1931. At the time of his death, he was a Trustee of the Worcester Polytechnic Institute.

Mr. Eddy was President of the American Society of Civil Engineers during 1934, and of the Boston Society of Civil Engineers in 1914. He was an honorary member of the New England Water Works Association, Boston Society of Civil Engineers and The Institution of Sanitary Engineers (Great Britain). He was also a member of the Institution of Civil Engineers (Great Britain), the American Institute of Consulting Engineers, American Water Works Association, American Public Health Association, American Chemical Society, and other technical and professional societies.

On graduation from the Worcester Polytechnic Institute he became superintendent of the Worcester sewage treatment plant, and from 1892 to 1907 he was superintendent of sewers for Worcester. In 1907 he entered into partnership with the late Leonard Metcalf, to organize the firm of Metcalf & Eddy.

During his professional career, Mr. Eddy served as consultant, or as a member of engineer commissions, for the great majority of important American municipalities. Had been frequently called upon to give expert testimony in important matters of litigation, such as New Jersey v. New York re diversion of the Delaware River; Wisconsin v. Illinois re diversion of Lake Michigan; Connecticut v. Massachusetts re diversion of Swift and Ware rivers and in the important activated sludge suits against Milwaukee, Chicago and other cities.

He served on the Technical Board of Review of the Public Works Administration and was consulted by the Tennessee Valley Authority. At the time of his death, he was one of the consulting engineers for the Board of Water Supply of New York City, upon the Delaware River project, and was serving also as one of the consultants for the Water Resources Service of the State of Pennsylvania, on the water supply of Pittsburgh, Harrisburg and Philadelphia.

During his professional career, Mr. Eddy wrote a large number of technical articles and delivered many papers and addresses—many of which were considered outstanding. He received the Desmond Fitzgerald medal of the Boston Society of Civil Engineers in 1920 and the Norman and the Rudolf Hering medals of the American Society of Civil Engineers in 1925. With Mr. Metcalf, he was joint author of the widely accepted three volume work, "American Sewerage Practice," and a textbook, "Sewerage and Sewage Disposal."

In looking back at Mr. Eddy's professional career two characteristics stand out; first, his thoroughness and capacity for hard work; second, his judicial attitude with respect to all problems. His opinions were reached only after careful search for and study of the pertinent facts; and, perhaps his outstanding characteristic was his dispassionate consideration of these facts.

On the personal side Mr. Eddy was kindly, considerate and of high ideals. Upon those who knew him, even casually, the force of his character left an indelible imprint. With his passing the engineering profession has lost a wise and honored member.

The surviving partners of Mr. Eddy—Charles W. Sherman, Almon L. Fales, Frank A. Marston, John P. Wentworth, Harrison P. Eddy, Jr., Arthur L. Shaw, and E. Sherman Chase—will retain the firm name of Metcalf & Eddy, with offices in the present location, Statler Building, Boston, Massachusetts.

▼

Charles Brossman Dies Suddenly

Charles Brossman, well-known consulting engineer of Indianapolis, died suddenly June 30th, as the result of a heart attack, while on a business trip. He was 60 years old.

Mr. Brossman was born January 17, 1877, in Philadelphia, Pa., where he received his training in the Philadelphia Manual Training School.

From the Baldwin Locomotive Works he went to serve as a member of U. S. Cavalry in the Spanish-American War and Porto Rican Expedition. He later became chief engineer for L. K. Davis and Company and had charge of design and construction of filtration and pumping plants for the Indianapolis Water Company. Thereafter, he had a responsible part in the construction of the first Washington, D. C., filtration plant.

In 1904, Mr. Brossman established his own engineering firm, with offices in Indianapolis, where he has been located ever since. In the mid-west, where best known, he has been connected with many municipal water supply and sewerage developments. As member of leading engineering and technical societies, he has contributed many worthy papers and articles. For 20 years he was secretary of the Indiana Engineers Association, and at the time of his death, was president of the Indiana Section of the American Society of Civil Engineers. He has long been an active member of the Indiana Section of the American Water Works Association.

Mr. Brossman leaves a widow, two daughters, one son, five grandchildren.

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A Correction

In connection with the report covering the Spring meeting of the California Sewage Works Association (our May issue), we desire to make the following corrections. On page 185, in the caption under the picture strip, we have mis-labeled Palo Alto's "Twin Operators" as Messrs. Lysle Peyton and Fred West, whose pictures correctly captioned appear on page 186. As properly recorded in the report, Palo Alto's operators are J. H. Kimball and T. R. Gregory. In this same strip of pictures, standing with Alexander Bell, is Ray F. Goudey—1st vice president of the Association—whose name, for some mysterious reason, fails to appear in the caption in any form.

Our apologies to Messrs. Goudey, Kimball, Gregory. It would appear that both of these errors are chargeable to none other than Ye Ed., himself, who prepared the captions from correct information supplied with the snapshots.—L. H. E.

RETIREMENT AND PENSIONING OF WATER WORKS EMPLOYEES*

Effect of Federal Legislation Thereon

By DALE L. MAFFITT

General Manager, Water Works, Des Moines, Iowa

The Author

THE importance of old age retirement or some adequate system of pensions has been especially emphasized in the far-reaching effects of the recent business depression. The swift collapse of the general economic structure and the slow process of recovery wiped out the accumulated savings of thousands upon thousands of old people, leaving them dependent for the rest of their lives on charity or organized assistance from the Government. The younger man who was sacrificing present wants for an anticipated future security has seen his savings evaporate in thin air and has been forced to accept Government aid along with his less provident neighbor. The result has been a general discouragement of saving from an individual point of view, and members of the younger generation are taking the attitude that they had better spend their money while they have it.

The growing magnitude of the industrial system and man's dependence on a social group is making it more and more evident that some provision must be made for adequate support of employees after they reach old age.

If during the last 50 years every employee had followed a general program of systematic saving, laying aside with an insurance company a stated amount out of each pay check, much of the suffering of the last eight years could have been avoided. We mention insurance because it has long been recognized as the most conservative and practical method of saving. Regulation of classes of securities in which insurance reserves may be invested has resulted in the growth of many strong and financially sound companies. It is also a method of saving which permits the laying aside of small amounts each month. However, the great masses have not taken advantage of this method of systematic saving.

The Status of Water Works Employees?

The economic developments of the last few years have forced the general public to become conscious of the need for some method of old age retirement. The result has been enactment of federal legislation incorporated in the "Social Security Act," approved August 14, 1935, and becoming effective January 1, 1937. The law is designed to provide some safeguard for the individual and family against the insecurity of modern life, through cooperation between the federal and state Governments. The provisions of the Act deal with a number of measures relative to Social Security, one of which is a pension plan for employees not over sixty years of age at the date the law goes into effect.

*A paper presented before the 57th Annual Convention of the American Water Works Association, at Buffalo, N. Y., June 8, 1937. The author is chairman of A.W.W.A.'s Committee on Social Security Legislation.

However, certain groups of employment are exempted from participation in the Social Security Act. Section 210 (b) (6) states one of these exemptions to include "Service performed in the employ of a State, a political subdivision thereof, or an instrumentality of one or more States or political subdivisions." This provision of the law excludes Water Works employees from participation in the old-age benefits under the Act insofar as Water Works companies are municipally owned. Since approximately 82 per cent of the cities in the United States of more than 10,000 population own the water systems operating within their limits, for the purpose of this discussion we shall assume that employees of Water Works organizations are not eligible to participate in federal old-age benefits. This puts them at a disadvantage, as compared with employees of industrial concerns.

What the Act Provides

In order to understand just what the federal Social Security legislation is offering to industrial employees, we wish to refer briefly to that section of the Social Security Act which has to do with old-age benefits. The Act provides two distinct measures for old-age security.

The first, under Title I of the Act, has to do with old-age assistance. This is gratuitous aid in cash given to old people without other means of support, and paid from general taxes without contributions from the beneficiaries. Old-age assistance is administered by the states, the federal Government merely giving financial aid to the states for part of the costs, provided the states comply with certain standards of administration and regulation as to eligibility set forth in the Social Security Act.

Title II of the Act has to do with old-age benefits. Under this plan regular benefits are paid to qualified individuals out of an "old-age reserve account." These benefits are in effect a right and not a gratuity, and have no reference to need. Qualified beneficiaries will be subject to special taxes which are expected to finance part of the costs. A qualified individual is one who is at least 65 years of age, who received total wages with respect to employment after December 31, 1936, (and before attaining 65 years of age) of not less than $2,000.00, and who has been employed in some five different calendar years after December 31, 1936, before attaining the age of 65 years, and whose wages do not consist of remuneration from certain exempted occupations, including in our analysis Water Works organizations. The minimum monthly benefit payment is $10.00 and the maximum $85.00. Benefits vary with the amount of wages received. Workers who have received less than $2,000.00 in total wages and whose employment falls in less than five different calendar years will, upon reaching age 65, receive a lump sum equal to 3½ per cent of their wages for included employment.

Benefit payments are to be made out of an "old-age reserve account." The Act authorizes Congress to appropriate each year an amount sufficient to provide for the payments required. The old-age benefits are administered directly by the federal Government, the states having nothing to do with their cost or administration.

Title VIII of the Act is connected in the popular mind with the old-age benefits referred to under Title II. Title VIII imposes two distinct taxes, payable into the Treasury of the United States,—an income tax on employees measured by wages paid them, and an excise tax on employers measured by payrolls. The employees taxed are the individuals to whom benefits will be paid under Title II. For the first three years the tax is 1 per cent on employee and 1 per cent on employer, excluding any excess of $3,000.00 paid to one individual in a year. In 1940 the tax increases by one-half of 1 per cent and every three years thereafter until the maximum rate of 3 per cent on both employee and employer is reached in 1949. These taxes are generally regarded as the source of revenue for the building up of reserves for payment of old-age benefits referred to under Title II. However, the legal responsibility of keeping the reserve fund adequate depends on Congress.

What of the Future of State and City Employees?

The states in general have not met the problem of retirement insurance. Certain groups of municipal employees have long been protected by old age pensions. Retirement systems for firemen and policemen are almost universal. Teachers' organizations have succeeded in establishing pension plans in many school systems.

The recent federal Social Security legislation has stimulated public sentiment in that direction and many groups which are not covered by the old-age retirement provisions of the Social Security Act are formulating plans for their own protection.

It is suggested by those opposing the Social Security Act that such a step would place the federal Government in the insurance business and in this manner compete with insurance companies. Further analysis of the problem, however, seems to show that there is little danger that such will be the case.

The old-age pension system of the Social Security Act is a compulsory annuity program. It is an endeavor by the Government to help workers to protect themselves, with the aid of their employers, against the economic insecurity of old age.

Industrial pension plans already in existence have been converted into plans supplemental to the federal plan. Edwin E. Witte, of the University of Wisconsin, writing on old age security in the Journal of Political Economy, February, 1937, states that the Social Security Act has operated to give a stimulus to the establishment of new industrial pension plans. He says, with reference to the effect of recent federal legislation, "at no time has the volume of new business done by insurance companies been as great as during this period."

Mr. Leroy A. Lincoln, President of the Metropolitan Life Insurance Company, thinks that the Social Security Act will stimulate rather than retard saving. In an interview for publication in Scholastic magazine, April 10, 1937, Mr. Lincoln was asked what effect he thought the Social Security Act would have on the business of the Metropolitan Life Insurance Company. He replied, "We anticipate that the Act will have no adverse effect on the thrift habits of individuals, but will rather stimulate them. Savings banks, life insurance companies, and similar institutions will continue to provide the individual with a way to make provision beyond the minimum of public plans, and more adequate and more appropriate to his own desires."

The Problem Before Water Works Managers

The problem before us is what effect federal legislation has had on the retirement and pensioning of Water Works employees. We see that where Water Works organizations are owned and operated by municipalities their employees are not eligible to participate in benefits as are those employed in private industry. Water Works employees want and need security, just as much as employees of any other group. Those in charge of the management of Water Works organizations are becoming more and more aware of this need, stimulated no doubt by the recent Social Security action. As time goes on and benefits accrue to employees retiring under the Social Security Act, Water Works employees are going to insist that some plan be devised whereby they may enjoy the same privilege of security that the industrial worker has been granted.

It is generally agreed that employers should contribute something to the costs of retirement allowances. No question is raised regarding charges for depreciation on machinery and equipment. A charge for the depreciation of the labor element is just as important. With a retirement system under which both worker and employer contribute, employers may humanely replace, with younger men, older employees who have become unproductive. The older men will be glad to retire because having independent means he will not have to eke out a meager existence living on the charity of children or state.

It seems self-evident that some plan should be devised for the retirement of Water Works employees on a pension that will permit them to live their unproductive years in comfort. Water Works organizations supply a public need, and the employees of a public utility render valuable service at an average wage, and are conscientious individuals employed for ability, quite often rendering faithful service over a long period of years. It seems the just and ethical thing that the organization should provide some plan of retirement for them.

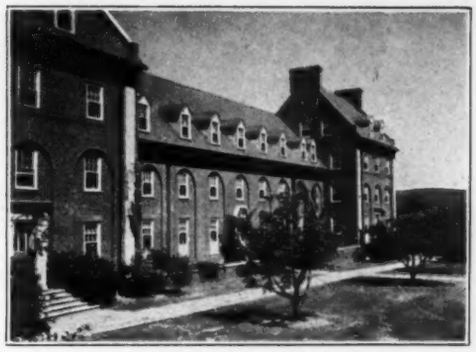
If Water Works employees are to have an old age retirement system it must be organized either as a plan in each individual community, or as a group plan for the American Water Works Association as a whole. In any case the plan should be based on the best actuarial statistics.

This is a period in industrial development in which Social Security is receiving special attention. The federal Government has assumed the burden of old-age benefits for the great mass of employees in private industry. But those certain groups which are not covered by the federal legislation must organize their own program. It seems to us to be a problem which Water Works executives are obliged to meet.

Erickson Succeeds Radebaugh as Manager, Champaign-Urbana Sanitary District

Carl V. Erickson, former assistant chief engineer of the Chicago Sanitary District, has been appointed Manager of the Urbana-Champaign (Ill.) Sanitary District. Mr. Erickson succeeds Gus H. Radebaugh, recently deceased, whose memory will live long as a man that did so much in respect to selling, to the public and municipal officials, sewage treatment for the mid-western territory. He was secretary-treasurer of the Central States Sewage Works Association, from its inception to his death. For several years, he was also a wheelhorse in the Association of Illinois Sanitary Districts.

PENNA. SEWAGE ASSN. HOLDS LARGEST MEETING



Frear Hall (Beds for All; Sleep for Few)

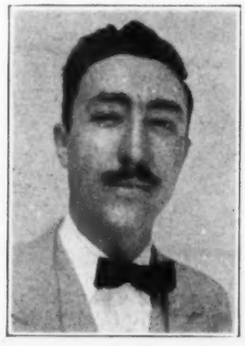
MEETING for its 11th Annual Conference at State College, Pa., June 21-23, Pennsylvania Sewage Works Association found a new attendance record established—the official registration being 160. Still more significant was the membership gain of 20 members during the conference. Added to 27 admissions within the year, the membership reaches a new high of 224.

"A Night in a Class-Room"

Not content with absorbing of information in day sessions, the State College conferences open the night before with a lecture by some worth-listening-to authority to draw early attendance. This year an added attraction to early comers was Pennsylvania's initial Gadget Contest which preceded the lecture.

The "opening-gun" of the conference was fired by a gunner of no mean ability at hitting the mark he aims at—Lewis V. Carpenter, New York University's Professor of Sanitary Engineering. In what may be termed "A Night in a Class-Room," with tactics of the teacher who refuses to let his class go to sleep on him, the professor lectured and quizzed his listeners on **"Things the Sewage Works Operator Should Know."** In fact he directed his fire at prominent consultants as effectively as at the lowly operator; also at chemist and manager. It was an evening of give and take, in which there was mixed in some humor, satire, philosophy, technical knowledge, common sense, and something of value to all. It lasted an hour—could have lasted another. The following questions were propounded—the answers came from members of "The Class" plus a few leads and assists given by the professor in blackboard outline. (No. 1) Why a sewage treatment plant? (No. 2) Sewage is what? (No. 3) How does your plant function—what does it do? (No. 4) How can you best sell your plant to the public? (No. 5) What operating and maintenance records should be kept? (No. 6) What are the qualifications of a good operator—Of a better operator?

Francis S. Friel, The New President



R. R. Cleland, Retiring President

It is regretted that limited space precludes more than mention of some of the important replies to question No. 5—in which it was shown that good operation follows good (honest) record keeping. In addition to the records required by the State Health Authority, odor records seemed of highest importance—some operators considering records of wind direction, velocity and possibly humidity of first importance. A plant diary, conscientiously kept up, was another. Power consumed and costs of operation and maintenance, sadly lacking, had proved throttling to advancement and understanding. A record of quality of stream above and below the plant had saved many damage suits. An honest record of hours of use of the bypass was suggested, as was a record showing chlorine on hand (for use) as well as that applied. Every operator was urged by Professor Carpenter to make out and file some form of annual report as a means of bringing accomplishments and needed improvements before his Commission or City Manager; also, for the benefit of others. As an example, he referred to the value of such mimeographed annual reports (funds lacking for printing) as those turned out by W. A. Sperry, Superintendent of the Aurora, Ill., plant.

Officers and Awards

With 150 attending the Annual Dinner, it was the largest in the history of the Association. As toastmaster "Ted" Moses poked fun at members and association "brass-hats"; inducted Penn. State's Professor "Pat." R. O'Donnell, a charter member and past president, into the association's honorary "Sigma-Sigma-Sigma" (Sludge Shoveller's Society); introduced the speaker of the evening, the Honorable E. J. Turner, Vice Chairman of the Interstate Commission on the Delaware River Basin, who spoke on allocation of waters, the use and abuse of streams and Pennsylvania's new Anti-Pollution Act (House Bill 158), requiring that industry abate pollution and tightening up on domestic sewage treatment.

Then were announced the winners in the Gadget Contest, arranged by "Bernie" Bush of the Department of Health. The winners of prizes of $5.00, and 2 year and 1 year subscriptions to WATER WORKS AND SEWERAGE were in order:

Harry Hancock, Operator, Dover, Del.

Frank Bubb, Operator, State College, Pa.

Grant M. Olewiler, Superintendent, Ardmore, Pa.

Officers announced for 1937-38 are:

President—F. S. Friel, Consulting Engineer, Philadelphia, Pa.

Vice-Pres.—C. F. Grace, Chief Operator, Polk, Pa.

Vice-Pres.—G. M. Olewiler, Superintendent, Ardmore, Pa.

Secy.-Treas.—L. D. Matter, Penna. Dept of Health, Wilkes Barre, Pa.

C. F. Grace (Polk), Vice-President; H. E. Moses (Harrisburg), Toastmaster; J. R. Hoffert (Harrisburg), Editor

Editor—J. R. Hoffert, Penna. Dept. of Health, Harrisburg, Pa.

Board of Control, Sewage Works Federation—Chas. A. Emerson, H. E. Moses.

"The Sewage Works Clinic"

A feature of note was "The Sewage Works Clinic" conducted by "Doc" Harry Freeburn who sought "diagnosis" by asking his "patients" questions to which the answers had been prepared in advance, the manner being that followed in broadcasting studio interviews. The scheme clicked, the audience voting for more in 1938.

"What is Sewage?" constituted "an interview" between Professor O'Donnell and "Doctor" Freeburn, in which was discussed the general composition of sewages; the effect of septic action and garbage added to sewage on treatment processes. Trying to determine the relative importance of colloids in sewages led to a highly involved floor discussion and more confusion than enlightenment. Gradually, it was expected, increasing quantities of garbage would be disposed of with sewage. Therein, the chief problem would be that of providing more oxidizing capacity rather than that of ability to handle the settleable solids.

By Dr. Rudolfs and Mr. Gehm it was pointed out that the pseudo-colloidal portions of sewage, garbage and trade wastes (those organic solids which were non-settling in ordinary sedimentation but flocced out after long standing or upon precipitation chemically, biologically or mechanically) was a most important consideration in treatment. Such material represented not less than 33 per cent of the total oxygen demand, depending upon the age and source of the sewage or waste.

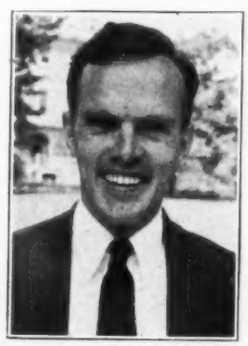
"Measuring Sewage Flows" was discussed by E. M. JONES, of Simplex Valve and Meter Co., who did everything with his script but stick-to-it. Notwithstanding, he gave operators and engineers many useful suggestions in meter maintenance and briefly described metering equipment and devices for sewage plants. Next to a Venturi tube, he recommended the egg shaped flume as the most satisfactory flow measuring unit for sewage—it having an accurate range of 1 to 100 volumes. The chief difficulty with Venturis, solid accumulations in float tubes, could be overcome by eliminating the pressure belts. To insure dependability, the cleaning rods should be used, flushing practiced, and the sediment traps blown frequently; piezometer lines should be air-bled and the meter cleaned at intervals. Matters to consider in installation included ample meter vault in size and head room, with a drain sump provided; adequate valving to isolate meter tube from service, care in grading and air chambers on lines to secondary units. The latter, operating on water differential (float tubes) were more sluggish to respond than those on mercury (pot) differential and, with frequent pump cut in, the record would be in error as a result. Asked for an opinion on the Parshall flume and the modification developed by Palmer for the Los Angeles County System, Mr. Jones said that flumes appeared satisfactory for flows of relatively little variation provided the concrete finish was accurate and smooth.

"Sewage Syphons" were figuratively taken apart and put back together by L. L. LANGFORD of Pacific Flush Tank Company. He described and illustrated the "deep-seal" type (with U trap immediately below the syphon bell) and the "trapless" type. The latter, consuming less head but requiring a tight discharge line serving as the seal, were especially useful in operating rotating filter distributors. Mr. Langford went into the principles of syphon functioning and methods of changing the draft (within limits) by reducing the seal depth in the blow piping. Smaller syphon chambers, effecting more frequent applications, were lately favored but, therein, design precautions were necessary to prevent air from entering under the bell and causing premature syphon discharge and deficient distribution. As to operating troubles, there were only two causes of any importance. The first was grease deposits accumulating in blow pipes. More important were slow air leaks in the piping connecting twin or multiple syphons. Ordinary plumbers seemed to have difficulty in making up air tight joints and much trouble had been traced to this fact.

L. H. ENSLOW, stating that shorter and more frequent applications having been found to produce more efficient trickling filter efficiency, wondered if it might be practical to reduce the volume of existing oversized dosing chambers by filling in with stone, concrete blocks or weighted steel drums to reach the desired frequency of dosing. Mr. Langford said that such was permissible, or that a portion of the chamber could be blocked off with a brick wall. Mr. Daniels reported that the scheme, suggested by Mr. Enslow and successfully applied in Pennsylvania, had advantages.

"Sewer Maintenance" by GRANT M. OLEWILER, Superintendent of Health and Sewerage for Lower Merion Township, Ardmore, Pa., constituted as replete a discussion of sewer maintenance as it has ever been this writer's privilege to hear presented. Unfortunately, space is not available to do it justice and the reader will do well to watch for the full paper in Sewage Works Journal. Mr. Olewiler explained the systematic method of flushing the entire system as practiced yearly —more frequent where justified. Working up from the lower end of the trunk sewers, manholes were first inspected and cleared of debris or obstructions. Each

Wm. C. Emigh, Coatesville. (A Past President; This Year, President Water Operators' Assn.)



John C. Geyer (Hails from Univ. of North Carolina); Soon Joins Johns Hopkins Staff

The Three Gadgeteers

G. M. Olewiler, Supt. Sewerage, Ardmore, Pa.; H. R. Hancock, Supt. Sewerage, Dover, Dela.; Frank Bubb, Chief Operator, State College, Pa.

lateral branch was flushed with the aid of a 625 gal. (truck mounted) tank equipped with a quick opening 8 in. dump gate, the secret of the successful flush being depth and velocity flow in combination. On laterals of 8 to 12 inch pipe (6 in. fall per 100 ft.) each flush was effective for 500 to 800 feet of sewer. The flushing crew consisted of truck driver, foreman and laborer. Much money had been saved by equipping the truck with a gasoline motor driven centrifugal pump to take water from the nearest pond or stream at a cost of $65.00 per year. Compared with purchased water in previous years, the cost was now $5.81 per mile for flushing better than 110 miles of sewer as against $18.95 per mile in past years.

After flushing, all needed repair work listed is taken care of. Reconstruction of manhole channels was done during low night flow hours, with the aid of a sheet iron bypass channel. In regrading of roads, the Sewer Department insists on making all manhole changes. A false floor of boards placed in manholes during such regrading had proved worth while in keeping stones, etc., out of the sewer. Manhole frames and covers were of the heavy duty type (350 lbs. total wgt.) the lids having a deep 3 inch lip, two lifting handles and pick hole. At lateral ends ventilating covers were especially desirable and also at intervals, such manholes having a sand-pan beneath each cover. Beneath loose banging covers the adhesive "Tapax" gasket tape was being used; in some cases asphalt was poured around the lid to prevent tampering or odor complaints. To open them, however, a blow torch is required. Manhole steps, formerly of galvanized pipe, were being replaced with galvanized wrought iron bars.

In routine cleaning operations, and root removal, a Champion Power Cleaner had proved its worth. As to rodding; so far only jointed wooden rods were used. (The "gadget" exhibited by Mr. Olewiler was a fishing tool for "lost" rods.—Ed.) In answering complaints of sewer stoppage, frequently the trouble spot was the point of connection of the house service into the lateral, reached most effectively with a jointed flexible pipe from the nearest manhole. Since the adoption of sewer rental, to cover adequate maintenance, complaints had been continually decreasing. Main-drain traps on services was a plumbing requirement.

As to pumping stations, cleanliness was considered of paramount importance as were screening and grit removal. The pumps, having automatic sequence control, were tested frequently for efficiency and clearance of impellers. With check valve trouble and storm damage the value of stand-by units had been amply demonstrated. They had found it cheaper to buy new impellers than to rebuild worn ones. At Reading, the opposite was the case according to A. F. Stone.

"Operating Experiences at the Lancaster Plants" were presented by GORDON J. WEIST, Chemist, Treatment Works, Lancaster, Pa., in an easy to follow and interesting review of experiences, correctives and results at Lancaster's two activated sludge plants. Especially troublesome had been sludge bulking at the South plant (5 m.g.d. avg. flow) due to industrial sewage from 4 breweries, one cotton bleachery, gas works and an abbatoir. Digestion had been seriously affected also, and there was much scum trouble and a very bad quality of supernatant liquor. The latter had been helped by improved distribution of solids to the digesters, sludge concentration before feeding, carrying less sludge in the digesters. Activated sludge was wasted to the crude sewage without difficulty. Sludge return and solids carried in the aeration tanks was controlled by use of the centrifuge test and dissolved oxygen determinations on catch samples at critical points in the aerators. Rate of aeration was held constant and at maximum, the sludge return being varied to maintain solids and oxygen balance. As long as between 0.2 and 1 p.p.m. of oxygen could be found in the mixed liquor all was well, but dropping lower than 0.2 parts trouble could be expected. Between 2,800 and 3,300 p.p.m. of solids could be carried in the aerators and 17,500 represented the maximum density which could safely be built up in the final clarifiers and have a satisfactory sludge for return. From the beds sludge cake was being removed under a 10 year contract, returning the city $500 the first year and sliding upwards to $1,000 per year.

In reply to many questions, Mr. Weist explained that dissolved oxygen surveys had shown the lowest concentration to be at the half way point of the aerators, with a gradual build up to the outlet where the routine tests were applied. Even though tapering the air (putting most of it into the first stages of aeration) it was difficult to keep abreast of the rate of oxygen demand without very careful sludge return control. On the opposite side too much dissolved oxygen at the aerator outlet resulted in straggling floc and poor clarification. The method of oxygen determination was to sample by submerging a bottle containing copper-sulphate, applying the Rideal-Stewart modification of Winkler's method

On the Campus Between Sessions

(1) *"Chicago's" Kappe, "Deac." Matter (Secy.), "P. F. T.'s" Langford;* (2) *"Just a Setting in the Sun!";* (3) *Al Genter (Baltimore), "Filtrations" Zack, Chlorine Institute's Faber;* (4) *"Lime and Alum," Otherwise Brumbaugh and Ockerhausen;* (5) *Tark (in Action) Beckett (from Rear), Bob. Mowry in profile.*

to the decanted sample. Gas works liquor had been the most recent cause of the greatest difficulties in operation. Prior to this difficulty, sludge bulking had been controlled by mild chlorination of returned sludge (10 to 90 lbs. per day) intermittently applied in accord with suggestions of the U. S. Public Health Service.

"What We Do at Dover, Delaware," was related by HARRY HANCOCK, Chief Operator of Dover's new plant, which provides garbage incineration, primary treatment and chlorination of 650,000 gals. of sewage daily. He had learned the importance of keeping the plant clean and odor free and explained methods of scum removal—the scum sweep used being one of three gadgets which won for Mr. Hancock first place in the contest. Lacking a gas holder they had gone against the manufacturer's advice and weighted the floating cover of the digester. This, resulting in increased pressure (8½ in. of water) and a partial substitute for a storage holder. "Believing it preferable to take a chance than to die from the shivers," the only detrimental effect noted by Mr. Hancock had been a lowering of the pH of the digester liquor somewhat, necessitating correction with lime. At one time they had added the alkaline Dover well water to raise the pH of the digester contents from 6.5 to 7.4 within 3 days, a suggestion of "Doctor" Freeburn. (Seemingly, here was a case of elutriation and acid neutralization combined.—Ed.) Since weighting the digester cover they had had a steady supply of gas (0.79 ft./capita) to heat the building and the digester, which seemed to function best at 90 deg. F. At this point Mr. Hancock's sludge sampler and his gadget for indicating gas pressure under the floating cover were displayed and explained. The garbage incinerator, guaranteed to burn at the rate of 20 tons per day, had actually burned 42,000 lbs. in a 9 hour run.

"The Usefulness of Laboratory Results" was discussed by WM. A. RYAN, Sanitary Chemist, Rochester, N. Y., who emphasized the misleading results that came from careful analyses unless the all important sampling was done in a manner to be truly representative of the average sewage received at the plant. He listed tests which were to be considered minimum for various types of plants; called attention to the dangers of too much routine testing and too little attention to the plant and various operating schemes looking toward economy and higher efficiencies. Concerning chemical treatment, the use of jar tests in arriving at correct dosages of chemicals was of high value and importance technically and economically.

Mr. Gehm stated that he had found it difficult with jar-tests to keep up with changing requirements when industrial wastes changed the sewage quality from hour to hour. S. I. Zack asked for the Perth Amboy experience in chemical control on a rapidly fluctuating industrial waste, stated that a dosage for average conditions was set. Flocking deficiencies were largely counteracted by the mechanical filters in the clarifiers. It was also pointed out that automatic chemical control would take into account quantity changes but there still would be the necessity of hand control to meet quality fluctuations. L. H. ENSLOW added that it was his opinion, based on experience and observation, that some degree of equalization of industrial waste flow (on the premises of the contributor) was an essential to satisfactory treatment—be it chemical or biological.

Industrial Wastes in Sewage Treatment

"The Effect of Industrial Wastes on Sewage Treatment" by JOHN C. GEYER, Engineer, The Textile Foundation, Inc., Washington, D. C.

Mr. Geyer, who has for some time been studying the effects of industrial wastes on sewage treatment plant operation, presented a well thought out discussion of this prevalently worrisome problem, concluding his talk with eminently practical suggestions toward securing relief. Of all wastes, the fermenting and greasy wastes were the most universally detrimental—milk wastes being the most so and packing wastes next. The simplest corrective measure was the equalization of quality and rate of discharge to sewers—attainable by installing holding tanks for emptying during the most acceptable periods of the day, to produce least disturbance to the sewage treatment process. For oxygen demanding wastes this well might prove to be during the hours of minimum strength of the domestic flow, for toxic wastes, during the hour of maximum flow and greatest dilution. Such proving insufficient it would be necessary to consider in order:

(1) Recovery Methods, involving re-use of liquors now wasted or recovery of by products. For

A Few of the 160 Registered

(1) Frank G. Diefendorf, Supt. Treatment, Erie; (2) J. H. Shertzer, City Engr., Lancaster; (3) E. E. Baltz, Pump Sta. Supt., Ardmore; (4) E. J. Rhoads, Supt. Treatment Plants, Lancaster; (5) Fred Fletcher, Engr. State Dept. Health; (6) E. B. Swinehart, Chief Operator, Pottstown; (7) C. N. Lauer, Plant Operator, York.

Charlie Young (Meadville) Had to Rush to Pittsburgh, Leaving Assistant Jim Harvey (Center) to Read His Paper. Everett Jones, "Cliniced" Metering and Then Ran the Golf Tournament.

Frank Daniels—Penna. Dept. Health, Chief Chemist; R. W. Haywood—Engr., W. Va. Pulp and Paper Company; Roy L. Phillips—City Engr., Meadville, Pa.

example—closed systems in paper product mills, grease and phenol recovery, lactose stock food and other products from milk wastes, sulphite and liquor from pulp mill wastes, copperas from steel pickling operations, activated carbon from paper mill waste.

(2) Changes in Manufacturing Processes. For example—those effected in corn-product plants at Decatur, Ill., and Chicago; paper pulp production.

(3) Preliminary treatment of the waste at the factory. For example—screening, sedimentation, chemical precipitation, neutralization.

Mr. Geyer was strongly of the opinion that the third alternative would be and had already proved the least practical or dependable unless under supervision of the municipal authority. Moreover, it had proved the most costly and least likely to prove satisfactory to either interest. On the contrary, chlorination at the source to suppress septization, odor production, sewer attack, might well prove a practical consideration as a simple treatment. He also referred to the possibilities of anticepsis with moderate chlorination or other chemicals to slow down or level off rates of oxygen demand in treatment, and in maintaining biological balance in aeration units to avoid dissolved oxygen depletion and process upset. He cited the all important factor of balance between rate of oxygen input and rate of use (depletion) in the activated sludge process, which told the difference between success and failure under heavy loadings of organic wastes. He commented on the importance of preliminary treatment, tapered aeration, sludge return control, chlorination of returned sludge—all for the single purpose of maintained aerobic balance as the first prerequisite.

L. L. HEDGPETH, Manager, Technical Service, Penna. Salt Mfg. Co., as discussor, complimented Mr. Geyer on his contribution and concurred in the argument against pre-treatment on the manufacturer's premises. The cost would be great and there was the expected lack of sympathetic operation of a plant which is automatically considered a "problem-child." Furthermore, there would be no cordiality between industry and the supervising municipal authority, if supervision be tolerated. He hoped that "patent medicine" principles would not be applied in selling industrial waste treatment and that consulting engineers would find it inviting.

C. L. SIEBERT, Penna. Department of Health, told of an activated sludge plant treating milk waste which had first had preliminary treatment, in which lactose was being precipitated as calcium lactate. He asked if anyone knew how much textile waste an activated sludge plant could stand? There was some speculation—no answer.

"The Coatesville Plant and Its Operation"—Wm. C. EMIGH, City Engineer, Coatesville, Pa.

Mr. Emigh, past president of the association, and this year president of the sister Water Works Operators Association, presented an illustrated description of, and reviewed operating experiences at, Coatesville's new treatment works designed as an activated sludge plant, but operated to provide primary treatment only.

Average flows of 1.94 m.g.d. reached maximums of 6 m.g.d. were being handled. With full automatic sequence, "cut-in and cut-out" variable speed (vertical) raw-sewage pumps deliver at rates increasing and decreasing in steps of 400 g.p.m. It had been learned that one-inch spaced bar screens were inadequate to protect pumps against rag chokages. Venturi tubes placed in the vertical discharge lines had functioned satisfactorily. The detritor between pumps and primary clarifiers involved spiral flow, assisted with air-jet agitation subject to variation. Each Straight-Line primary clarifier was individually Venturi metered and equipped with an effective variable elevation dipping scum take-off trough. The device consisted of a horizontal section of pipe with a slot cut full length. Subject to cross tank levelling and handle turning, the slot could be dipped to skim as deep as necessary and from front to rear. It had proved most satisfactory, all scum going to the sludge sump.

From the clarifiers sludge passed by gravity to a sludge collecting well through sluice gates on each clarifier. These gates, electrically and automatically controlled by elevation of sludge in the collecting well, had been a source of much trouble from sticking and automatic control had seemed so impracticable as to justify manual control in the future. From the collecting well to concentrating tank the sludge was pumped and after decantation was distributed by gravity to the 4 digesters. Between the decanting tank and the digesters was an up-flow tubular heat exchanger, providing 15 minute contact and sludge discharge temperature of 80 to 85 degrees F. Uniformity of operation had been difficult because of variations in sludge flows. The Venturi meter on the sludge line had been unsatisfactory, possibly because of its oversize for present duty.

The digesters are equipped with agitating pumps (bottom to top) which had been intermittently operated, gas flow from the digesters practically ceasing following each agitation. Because of sufficiency for primary treatment, Mr. Emigh explained that only one of the four digesters had been continuously used. Leaking digester roofs had been a problem, which contraction in cold weather made more pronounced. To a 10,000 cu. ft. holder the gas flowed through meters. Such being subject to reverse operation, when sludge or liquor drawing drew gas back into the digesters; therefore, a check valve by-pass arrangement had to be provided to

Helped Make the "Clinic" a Success

L. L. Langford on "Syphons." H. R. Hancock, on "Things We Do at Dover." G. M. Olewiler, on "Sewer Maintenance." (To Each We Give 100 Per Cent.)

From Cleveland and New York

Geo. B. Gascoigne and Frank D. Young, Consulting Engrs. Wm. L. Sylvester, Asst. Chief Engr., New York City's Dept. of Sanitation. (Their First State College Meeting—Not Their Last, All Agreed.)

obtain more accurate registration of gas yields. The reaction of digester contents had leveled out at pH 6.8 after boosting to 7.4 with lime. From the glass covered beds sludge cake had been satisfactorily removed with as much as 75 per cent water content. The plant was equipped with a separate flushing water system utilizing plant effluent. Indicating-recording equipment had been profusely supplied and, since completion, the plant had been fenced in and flood-lighted. The completed project had cost $375,000 of which $100,000 had been spent on sewer construction.

F. E. DANIELS (Penna. Dept. of Health) as discussor, felt that there was needless complexity and too many untried contrivances in the Coatesville palnt, many of which operating experience would have circumvented. It was a shortcoming of designers, in general, that such operating experience was lacking and one corrective would be to hold designers responsible for operation. In such highly mechanized and instrumented plants as Coatesville's highly skilled operators and able mechanics were as essential as was laboratory checking. For moderate sized works such expensive design, equipment, maintenance and operation was in Mr. Daniel's mind open to serious questioning—that is, if we interpret correctly. Based on some years of observation he was of the opinion that untried designer inventions generally constituted too much of the experimental and, as a practical consideration, equipment already put through preliminary tests by manufacturers before introduction, or already standardized, was the far safer plan for the good of all concerned—not the least being the plant manager and operators. At this point Mr. Daniel's memorialized the late Harrison P. Eddy, who having been an operator, was conservative, cautious and hard to stampede.

Bio-Flocculation

"Bio-Flocculation of Sewage" as reviewed and discussed by H. HEUKELEKIAN, Bio-Chemist, New Jersey Experimental Station, New Brunswick, N. J., proved to be a topic of timely interest to his audience.

Mr. Heukelekian explained that bio-flocculation was represented in the primary (non oxidizing) stages of the activated sludge process, trickling filters, contact beds; also in shallow streams heavily loaded with sewage or unoxidized effluents. It was Nature's precipitation method. Aerated contact beds known as colloiders had been developed for bio-flocculation. He traced the history from the early Jones and Travis Colloiders to the Nidus Racks of Buswell; the aerated submerged coke beds (Tank Filters) of Bach and Imhoff; the Hayes' aero-precipitators at Waco, Texas. The high-rate sprinkling filters of Halvorson and Jenks represented the newest development, the basic effects produced being bio-precipitation of pseudo colloids on the slimy stone surfaces to be washed through as settleable flocculated matter.

An outstanding example of the practicability of bio-flocculation vs. the activated sludge process was cited as that at Indianapolis. There Calvert had proved that discontinuance of sludge return and straight aeration, to effect bio-flocculation without proceeding to the more costly nitrification stage, returned the greatest overall purification in pounds of oxygen demand removal per dollar expended in plant capacity and power demand. At Decatur, Ill. (without sludge return) 0.4 cu. ft. of air per gal. during 2.5 hrs. aeration, produced 33 per cent reduction in B.O.D. in the settled liquor. Between 0.17 and 0.40 cu. ft. of air, the reduction ran from 17 to 37 per cent—which return of 9 per cent sludge did not increase, and return of higher amounts decreased. In Germany, with 0.2 cu. ft. of air passing through submerged coke beds providing 30 to 60 minute contact (Bach and Imhoff's "Tank-Filters") had effected 30 to 40 per cent additional B.O.D. reduction above plain settling. At present mechanical agitation for periods of 30 minutes and longer had been proving effective in natural flocculation, and various degrees of purification.

Mr. Heukelekian in discussing the theory and practical considerations, stressed the importance of ample contact surface (at least 20 to 1); the necessity of keeping the floc or slime coating aerobic and preventing their accumulation in contact chambers. He cited the value of artificial surfaces such as clay, chemical floc and the like, to supplement or in part substitute for putrescible floc or add to its settleability. Although the exact phenomena or organism responsible for bio-flocculation had not been susceptible of easy identification, the effects were well understood and deserved attention as a practical intermediate treatment process. Comparable in effectiveness to chemical precipitation, costs would be the deciding factor in selection of process. It was true in both processes that the degree of purification attainable would depend upon the nature and age of the sewage or waste.

CHAS. H. YOUNG, Penna. Dept. of Health, Meadville, Penna., as discussor, pointed out the significance of Indianapolis attainments with 7.5 hrs. straight aeration having effected an overall 59 per cent B.O.D. reduction at a cost of $3.46 per 1000 lbs. removed; of a like removal attained at a New Jersey State Hospital with 4½ hours aeration; at Decatur with 2.5 hrs. and 0.4 cu. ft. of air a 37 per cent removal from pre-settled sewage. All of these results were without sludge return.

Mr. Young stated that at present, based on experimental findings, a plant in Pennsylvania to treat 1.33

Helped Enslow With His Chlorine Story

G. J. Weist, Chemist, Lancaster Treatment Works. (The "Lions" Who Cross-Questioned Found Him a Daniel.) Hal. Hutton, Asst. Sales Mgr., Wallace and Tiernan Co. (Told of Sewage Chlorinators of 6,000 Lb. Capacity.) Ted Haseltine, Supt. of Treatment, Butler, Pa. (Put the New Topeka, Kans., Plant to Work; Came to Butler, Made One Settling Tank Do the Work of Two.)

John H. Hood, Supt. Treatment, Ridgewood, N. J.; Geo. H. Boone, Supt. Treatment, Norristown, Pa.; Bernie Bush, Pennsylvania Dept. of Health, Wilkes Barre, Pa. (Secy. Matter's Right-Hand Ran the Gadget Show.)

m.g.d. would employ aero-flocculation, settling (filtration later if needed) and chlorination to reduce oxygen demand 50 per cent or better; non-settling solids 30 to 50 per cent; turbidity 20 to 40 per cent. The whole of the power for operation was to be supplied by gas engines. In this scheme chlorination was for the purpose of added B.O.D. reduction and delayed oxidation rates below the plant.

M. B. TARK (Link Belt Co.) recounted results of 1.5 hours plain mechanical aeration at Collingswood, N. J., reducing B.O.D. 25 to 30 per cent—longer aeration having no added value. Dr. Rudolfs stressed the fact that attainments with bio-flocculation had been found to vary considerably on different sewages; and were not subject to predictions without experimentation or a definite knowledge of the sewage to be dealt with. The scheme, however, had tremendous appeal and its possibilities deserved thorough exploitation. Mr. Gehm reported that the new chemical precipitation plant at New Brunswick, N. J., with mechanical flocculators and chlorination, had already produced 70 per cent removal of suspended solids without benefit of precipitating chemicals.

GEORGE B. GASCOIGNE, Consulting Engineer, Cleveland, O., expressed much interest in the potentialities of bio-flocculation; said that the process was being installed ahead of trickling filters at Cleveland to relieve loadings. Involved was tapered-aeration and between the bio-precipitation tanks and the sprinkling filters were magnetite filters in place of settling tanks.

"Activated Carbon—Its Place in Sewage Treatment" by R. W. HAYWOOD, JR., Technical Service Engineer, W. Va. Pulp and Paper Co., New York City.

Mr. Haywood briefly reviewed the accomplishments of activated carbon as an aid in sewage treatment for odor control, reduced scum formation on tanks and digesters, improved sludge digestion—stating that much remained to be done in the way of better evaluating carbon for such purposes, and cited the several plant scale studies now in progress. He showed moving pictures of the Newark, Rochester, Fairport, Pottstown and Norristown plants now using carbon.

E. B. SWINEHART, Superintendent of Treatment Works, Pottstown, Pa., reported experiments under way with carbon (54 lbs. per M.G.) added to one half the flow and none to the other. Split plant observations had shown a rise in digester temperature of 2 degrees, odor control in raw sludge handling, some increase in gas production, noticeable reduction in scum on the primary tank. He was of the opinion that carbon was wasted when the dosage was enough to show in the settled sewage and had found feed variation with flow an economy and advantage.

JOHN W. HOOD, Superintendent Treatment Works, Ridgewood, N. J., told of a recent experience with digester foaming which had been controlled by adding carbon. He gave the history, but the dosage of carbon was not stated.

Aspects of Sewage Chlorination

"Aspects of Sewage Chlorination in 1937"—by L. H. ENSLOW, Editor, WATER WORKS & SEWERAGE, and Engineer, The Chlorine Institute, New York, N. Y.

Mr. Enslow briefly traced the history of sewage chlorination developments, amongst which some worth while usages had resulted. Aside from its preeminent place as a disinfectant, the most important general usage had been up-sewer applications for the primary and important purpose of keeping fresh sewage as fresh as practicable during its travel through long or flat sloping sewers to the treatment works. In brief: Fresh sewage would not create odor nuisance; would not create hydrogen sulphide attack (acid disintegration) of masonry sewers and metal parts; was much more amenable to dependable and economical treatment by biological or chemical processes. In this, practicing "an ounce of prevention, etc.," results had been attained with minimum amounts of chlorine. Fresher sewage had meant higher permissible loadings on plants least able to cope with septice sewage—notably the activated sludge process. In respect to the latter process homeopathic chlorination of returned sludge had been in more than one instance able to establish biological balance to the extent that filamentous growth, and concurrent sludge bulking, had been brought under control.

Where early chlorination for checking degradation was not practicable, the indirect method of chlorination had been more economical and effective. By this he referred to the chlorinated-iron scheme of passing the chlorinator discharge through iron scrap or tin cans and converting the chlorine to ferrous chloride (not ferric). The iron had the ability to "fix" the odorous and acid producing volatile sulphide. The added iron had distinctive values in later aiding sewage treatment processes. In many recent instances, therefore, the chlorinated-iron process had been favored for one or more reasons. In others the combination of up-sewer simple chlorination and the iron process just ahead of the treatment works proved a happy combination on all scores. For forming persistent chloramines in sewages the combination of lime and chlorine was most effective and overall more economical than simple chlorination.

In chemical treatment "chlorinated-copperas" had been proven an effective and economical coagulant, alone or with lime as the case demanded. The introduction of non-precipitating dosages to sewage had been effective in materially increasing tolerances in loadings on trickling filters—floc formation taking effect in a decolloidizing manner during passage through the stone beds.

The newest development, now under study, was the

C. F. Wertz, Gascoigne and Associates, New York City; D. E. Davis, Chester Engrs., Pittsburgh; A. F. Stone, Supt. Treatment Works, Reading

introduction of chlorine gas into the air lines going to air blowing grease separation units. The increased yield of grease had been rather astounding—reaching 400 per cent of that released by straight aeration from sewage carrying wool scour wastes. Further tests were under way at Baltimore where only domestic sewage is involved and present reports reveal an equal advantage from the chlorinated air. This phase of pretreatment had especial significance in connection with activated sludge treatment or bio-flocculation—both being seriously interfered with by grease or oil.

Mr. Enslow stressed the value of the work of Rudolfs, Gehm and co-workers in establishing the potentialities of efficient rapid mixing of chlorine applied in disinfection; of its especial effectiveness in partial chlorination and also the values of long contact thereafter (sewer chlorination) in extending disinfection efficacy considerably beyond expectancy with moderate economical dosages. Also the New Jersey Experimental Station had confirmed the value of chlorine in permanently reducing oxygen demands of effluents and this had done much to increase chlorine application for that purpose. With growth of precipitation processes (biological and chemical) more should be heard of attainments of chlorine in this direction—namely, seasonal betterment of effluents in putrescibility reduction and economy.

HAROLD S. HUTTON, Assistant Sales Manager, Wallace and Tiernan Co., as scheduled discussor, was asked by Mr. Enslow to present some of the newest developments in chlorinating equipment. He recounted the step up in capacity of chlorinators for sewage—720 lbs. then 2,000 lbs. and, now, going to 6,000 lbs. capacity machines for plants under design. This had not been as simple as the saying of it—all because of the low solubility of chlorine gas in water and adaptation of the safety principles of full vacuum type chlorinators. Chlorinators were now equipped for program clock control in stepping-up and reducing dosages automatically from hour to hour; for intermittent operation; for solenoid control with pumping operations; for full automatic (metered) control; chlorinators feeding on the basis of automatic residual chlorine maintenance. Because of the multiplicity of application points at sewage plants, long 2-inch and larger rubber lined distribution lines had been installed. Pressure systems, making use of effluent for operating chlorinators in the absence of adequate water supply, or to reduce water bills, had been effectively utilized.

DR. RUDOLFS stressed the point made by Mr. Enslow concerning the high importance of keeping sewage fresh —a matter which deserved maximum emphasis. Practice of this principle could, and had, saved municipalities much money. As an example—assurance of odorless operation had made it feasible to locate the new treatment works of New Brunswick practically in the heart of the city. Such a location would not have been acceptable a few years ago because of odor possibilities and no ready means of prevention. In New Brunswick an expensive outfall to a remote location and pumping costs of $18,000 annually were saved thereby. In other directions chlorine had come into the sewage treatment picture to ease the path for sewage plant operators and designers and make possible the satisfactory and effective operation of plants which had before been unattainable. In the activated sludge process chlorine could be a helpful tool, as stated, but here was a situation demanding greater care in chlorine regulation to preclude over-doing the job than in any other aspect of sewage chlorination. Dr. Rudolfs paid a high compliment to the vision of the group of manufacturers who some 12 years ago formed The Chlorine Institute and established sewage chlorination research under Mr. Enslow's direction. He had secured the aid and cooperation of health departments, cities, universities, operators; and, what 10 years ago was nonexistent in sewage chlorination, today was a boon to operators and engineers. At the same time much worth while new business for chlorine manufacturers had been their return. For this type of industrial research sewage authorities and operators were indebted.

T. R. HASELTINE, Superintendent of Treatment, Butler, Pa., stressed the importance of concentrating activated sludge prior to delivery to digesters. He had recently been connected with the new Topeka (Kansas) plant where thickening in separate sludge concentration tanks was provided. Chlorine was merely added to the water above the sludge blanket to maintain low residuals and suppress biological action, thus allowing the sludge to compact without a reversal of the shrinking process which could be changed to deoxygenation and swelling due to biologic activity. Since coming to Butler he had an opportunity to observe the effects of prechlorination in raising the efficiency of the settling units and B.O.D. removal—particularly since the advent of warm weather. He read laboratory data to show the improvement in solids and B.O.D. removal by two clarifiers in series. With only partial prechlorination, the first clarifier in the series seemingly did a superior job to that of the two previously. His intent was to change to parallel operation, with the possibility of further improvement. If there proved to be none, he seemingly had one clarifier too many.

G. J. WEIST, Chemist, Lancaster Works, told of the effective results during 6 months of intermittently applied moderate chlorination of returned sludge, per recommendations of Purdy and Smith of the U.S.P.H. Service, to control sludge bulking—the chlorine dosage varying, when applied, between 2 and 18 lbs. per million on the basis of sewage treated. The wide range in dosage was for the purpose of determining dosage economy, efficacy and upper limits. The filamentous growth accompanying bulking, if not responsible for the phenomena, had been controlled. In the winter and early spring chlorination had not been required: and now, gas house waste was the chief upsetting factor.

In thanking the speaker and the discussors, the new president, Francis S. Friel, took occasion to add a personal word of appreciation to that of Dr. Rudolfs, for the contributions of Mr. Enslow and The Chlorine Institute, for having made such work possible.

Golf Tournament

(Everett Jones in Charge)

On the afternoon of the last day was staged the Annual Golf Tournament between members of the Sewage Works and the Water Operators' Associations. The winners of the 16 prizes were:

Low Gross—Ralph Tyler, Scottsdale, Pa.

Low Net—C. F. Wertz, New York City.

Kicker's Handicap—(1) W. H. Wier, (2) F. B. Young, (3) W. B. Johnson, (4) R. L. Phillips, (5) E. K. Jenkins, (6) R. R. Cleland, (7) L. A. Monroe, (8) R. S. Mark, (9) R. C. Beckett, (10) J. B. De Groot, (11) C M. Hess, (12) D. E. Davis, (13) L. V. Carpenter, (14) H. M. Freeburn.

Amongst manufacturers' representatives:

Low Gross—Frank Milne, Hersey Meter Co. 2nd Low Gross—Bob Haywood, W. Va. Pulp and Paper Co. 3rd Low Gross—L. J. Evans, Mueller Co.

EXPERIENCE WITH BENTONITE IN THE PURIFICATION OF SEWAGE

By H. L. OLIN, CHAS. L. CAMPBELL and J. V. GAULER

Department of Chemical Engineering,
University of Iowa, Iowa City, Ia.

IN a recently published paper[1] from this laboratory we described the results obtained in treating turbid water supplies with bentonite clay, pointing out that a rapid and highly effective flocculation of the colloidal silt was brought about, leaving a readily filterable water of high purity. So positive was the action of this medium on the silt dispersion in the water that its use for clarifying an even more complex colloidal system, that of raw sewage, was immediately suggested and tried on the laboratory scale. Preliminary studies on the dosage of a screened but otherwise untreated domestic sewage with relatively small quantities of a bentonite slurry show a rapid flocculation and sedimentation of a large percentage of the emulsified organic matter, leaving an effluent of a purity comparable to that from the conventional trickling filter. This paper covers the main features of an investigation made with the use of a clay of high colloidal content.

Bentonite is defined as a rock composed essentially of a crystalline clay-like mineral, mainly a hydrous aluminum silicate, formed by devitrification and chemical alteration of a classy igneous material, usually a tuff or volcanic ash, and often containing accessory crystal grains of feldspar, biotite and quartz. It is widely distributed, occurring in strata from a few inches to several feet in thickness, in South Dakota, Nevada, New Mexico, Wyoming, California, Utah, Texas, Idaho and Canada. It swells reversibly in water to at least six times its original volume to form a gelatinous mass with the consistency and appearance of grease and in the form of such a suspension more or less diluted it may be conveniently applied to the system to be treated.

Experimental Work on Raw Sewage

Included in the sewerage system of the city of Iowa City is a disposal plant consisting of Dorr clarifiers to which the raw sewage is pumped for preliminary sedimentation after passing the grit chambers and screens. The underflow from the clarifier goes to sludge tanks while the effluent flows to trickling filters where the purification, so far as it goes, is completed. These preliminary laboratory studies were made on the raw sewage collected at the pumps which deliver the feed to the Dorrs; the samples were given only a simple screening through an 8 mesh sieve before being dosed.

The tests were extremely simple in principle. From each of the six 5 gallon samples collected at the plant seven one liter subsamples were measured into Imhoff cones, the first to be tested in the raw condition, the second to be given a two hour sedimentation without addition of clay, and the rest to be dosed to produce bentonite concentrations of 50, 60, 70, 80, and 100 p.p.m. respectively. Each specimen was allowed to stand for 2 hours while settling rates were under observation; change of volume of sludge in the apex of the cone was noted during this period. Following this procedure the partly clarified portion was tested for alkalinity, turbidity, pH, total solids and biochemical oxygen demand (B.O.D.).

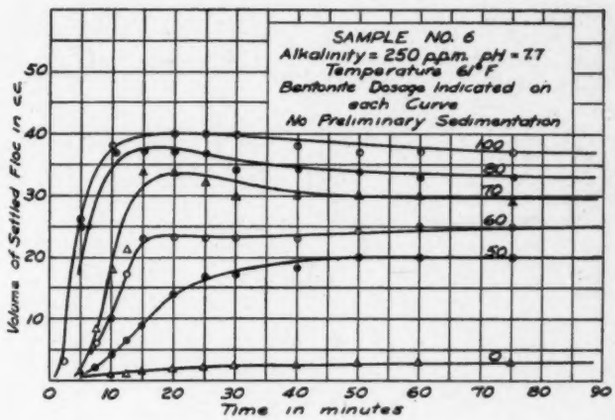


Fig. 1—Flocculation of Sewage with Bentonite; Sedimentation Rates with High Alkalinity

Settling Rate Studies

The response of the samples treated with the bentonite dispersions was immediate and striking. In cases where the alkalinity was high, i.e., where little or no dilution had been produced by inlet of storm water and where other conditions were favorable, the emulsion broke visibly within five minutes to form large, rapidly settling flocs. In Figure 1 are plotted the results of such a settling rate test, e.g., Run No. 6 when temperature was 61° F. and alkalinity 250 p.p.m., from which it may be seen that with dosages of 80 and 100 p.p.m., floc volumes reached a maximum within thirteen minutes. The untreated sample required 105 minutes to attain its maximum of 3.6 cc.

In other cases, however, at lower temperatures and alkalinities a marked lag was noted in the break of the colloid and smaller floc volumes were formed although net purification was not much below that obtained in cases where sedimentation was rapid. (See values for sample 5 in Table I.) Figure 2 presents graphic results of such at series of tests, Run No. 5, where with lower temperature (53° F.) and particularly with lower alkalinity (180 p.p.m.) due to dilution with rain water in the sewers, conditions were distinctly less favorable than in Run No. 6 and in extreme cases of dilution the addition of lime or some other electrolyte would be necessary. Maximum coagulation and settling occurred, however, in 90 minutes, well within the 2 hour detention period allotted. It is readily seen on the other hand that the sedimentation of the untreated sample under the same conditions is correspondingly slow and unsatisfactory.

The presence of "humps" on the upper curves of Figure 1 is graphic evidence of a settling or packing of the newly deposited sludge which takes place soon

after its deposition, indicating that it has a fairly high density, sufficiently great at least to bring about ready sedimentation.

At this stage of the work no study has been made of the effect of the bentonite upon the digestibility of the sludge. There is little reason to suppose, however, that the presence of small amounts of a sterile, finely divided clay substance would inhibit or retard bacterial action in the sludge tank. Indeed such contamination in the form of silt or clay entering the sewerage system with storm water is common to most installations of the kind. Clearly evident on the other hand is the greatly improved physical condition of the artificially precipitated sludge with respect to speed of sedimentation, due fundamentally of course to the completeness with which the emulsion is broken down.

Results of Bentonite Dosage

Detailed results of analytical tests of the effluents to which bentonite dosage had been applied (including also results on raw and settled sewage) are given in Table I, following methods specified in "Standard Methods for the Examination of Water and Sewage," Eighth Edition. Turbidities were measured with the Hellige turbidimeter and pH values by means of the Beckman pH meter. The wide range of turbidities in samples (1) to (6) is due to the fluctuation in the amount of silt brought in by storm waters, since the city's sewerage system is not completely isolated from that providing for street drainage. With high turbidity from this cause is associated of course low alkalinity.

Inspection of these data show that a 2 hour detention

TABLE I.—RESULTS OF BENTONITE DOSAGE OF RAW SEWAGE.

Bentonite dosage	Sample No.	Alkalinity p.p.m.	Turbidity p.p.m.	Total Solids p.p.m.	B.O.D. p.p.m.	B.O.D. Reduction per cent (a) Based on Raw Sewage	B.O.D. Reduction per cent (b) Based on Settled Sewage
Raw (No bentonite added.)	(1)	265	550	916	422		
	(2)	246	375	1002	383		
	(3)	280	413	840	370		
	(4)	134	1100	764	289		
	(5)	181	625	630	378		
	(6)	246	550	946	396		
	(7)	303	700	1008	374		
	Average	236	616	872	373		
Settled (These samples were settled for 2 hours.)	(1)	260	300	730	186		
	(2)	258	150	662	188		
	(3)	320	338	786	190		
	(4)	132	550	494	178		
	(5)	187	305	496	191		
	(6)	253	165	750	192		
	(7)	309	275	686	184		
	Average	246	298	658	187	50.0	
50 p.p.m. (These and the following samples were raw sewage, screened through an 8-mesh sieve but not settled before addition of bentonite.)	(1)	254	45	618	101		
	(2)	260	37	590	71		
	(3)	289	50	644	95		
	(4)	132	275	408	92		
	(5)	180	190	468	90		
	(6)	249	43	634	82		
	(7)	309	60	626	89		
	Average	239	100	570	88	76.4	53.4
60 p.p.m.	(1)	268	47	602	93		
	(2)	264	34	554	67		
	(3)	289	34	666	71		
	(4)	133	213	406	71		
	(5)	180	190	450	78		
	(6)	249	40	680	70		
	(7)	307	50	654	80		
	Average	241	93	573	75	80.0	60.0
70 p.p.m.	(1)	268	36	576	68		
	(2)	260	31	558	53		
	(3)	290	31	610	61		
	(4)	132	175	382	42		
	(5)	180	180	448	71		
	(6)	251	37	648	62		
	(7)	304	48	586	69		
	Average	241	77	544	61	83.6	67.3
80 p.p.m.	(1)	268	32	674	51		
	(2)	254	28	546	47		
	(3)	290	31	708	52		
	(4)	133	165	396	36		
	(5)	178	165	456	54		
	(6)	250	37	658	56		
	(7)	302	40	632	57		
	Average	239	71	581	50	86.5	73.2
100 p.p.m.	(1)	254	31	634	20		
	(2)	256	25	552	22		
	(3)	290	25	610	28		
	(4)	133	150	362	28		
	(5)	179	135	464	31		
	(6)	248	32	628	29		
	(7)	298	37	646	26		
	Average	234	62	557	26	93.0	86.1
200 p.p.m.	(1)	268	22	608	15	96.0	92.0

Note: pH values of all samples under all conditions were approximately constant around 7.6.

of the raw sewage, without dosage, brings the B.O.D. from an average value of 373 down exactly 50 per cent to 187, which compares favorably with the average of value of 208 for the effluent from the Dorr clarifiers at the Iowa City plant during the six fall and winter months the disposal system has been in operation. Dosages of laboratory samples ranging from 50 to 100 p.p.m. (416 to 833 #/MG.) of bentonite produce corresponding B.O.D. values of 88 to 26 p.p.m.; an application of 200 parts made in an isolated test left only 15. Average values for the B.O.D. of effluents from the trickling filter and final clarifier of the Iowa City plant lie between 30 and 40 p.p.m. and it follows that to obtain equivalent purification with the use of the bentonite coagulant, a dosage of between 80 and 90 parts would be required, corresponding approximately to 700 pounds of the clay per million gallons of sewage.

Bentonite Dosage of Pre-Settled Sewage

The marked reduction in B.O.D. values of the raw sewage noted above brought about by subjecting it to a 2 hour sedimentation was obviously due to the removal of the coarser matter temporarily suspended in the water; most of the colloidal system, both solid and liquid, was retained in the effluent. From the standpoint of operating economy it is reasonable to assume that natural sedimentation should in general be employed wherever possible, leaving artificial means for situations that demand special treatment. Accordingly in a second series of tests all subsamples to be dosed with bentonite were first allowed to stand for 2 hours to deposit their free-settling load to determine the possibility of reducing the dosage necessary to bring about a given purification. Results, however, showed B.O.D. values little if any lower than those obtained with equal bentonite dosage of the unsettled sewage given in Table I, indicating that the clay acts almost exclusively upon the colloidal system, which remains constant regardless of the amount of gross material present. As shown in Figure 3 the time required to break the colloid, and the final volume of the floc, are functions of the concentration of the dose. Indeed it seems evident from comparison of the curves of Figures 1 and 3 for raw and presettled sewage respectively, that the presence of coarse material that settles readily by gravity hastens the sedimentation if not the coagulation of the colloidal matter. In any event the time lag at low concentration of bentonite indicated in Figure 3 is significant and it is possible that presedimentation may produce a definitely negative rather than a merely neutral effect on the adsorptive reactions and removals by the clarifier.

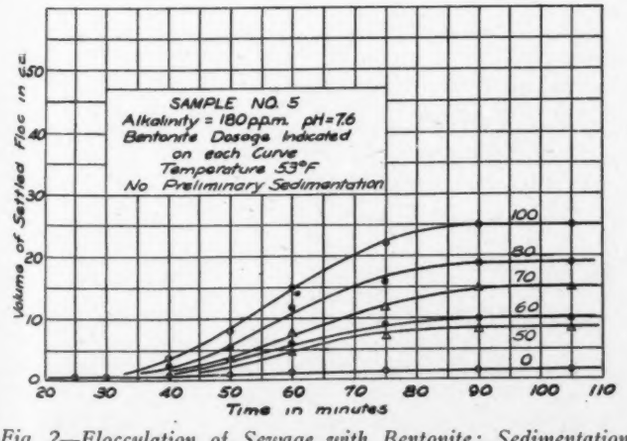


Fig. 2—Flocculation of Sewage with Bentonite; Sedimentation Rates with Low Alkalinity

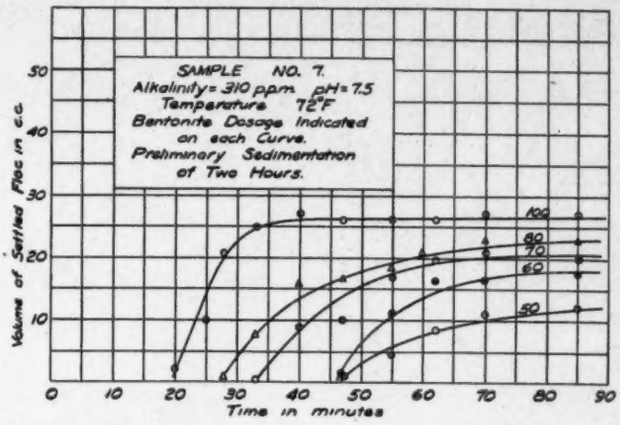


Fig. 3—Flocculation of Pre-Settled Sewage; Sedimentation Rates

The Chemical Treatment of Sewage

In a comprehensive review of the chemical treatment of sewage the Committee on Sewage Disposal of the American Public Health Association[2] list over 60 United States patents and nearly 250 journal articles relating thereto. In principle they cover a wide range of technique from the use of brewer's yeast and other biological growths, through a long list of coagulants to methods of electrolysis, and in date they extend from 1873 to 1935. The report is too voluminous to be readily abstracted; some of the significant conclusions of the Committee follow:

"1. Chemical treatment usually accomplishes a degree of treatment between plain sedimentation and biological processes.

2. The seasonal or occasional use of chemicals is attracting favorable notice in situations where sedimentation alone may suffice for the greater part of the year or for many years out of a cycle.

3. The use of chemicals as a preparatory treatment in addition to sedimentation ahead of biological filters is practiced in many situations, and prolongs the useful life of existing plants, otherwise overloaded.

4. Of the various processes for chemical treatment of sewage considered in the United States, the use of iron salts, particularly ferric chloride or ferric sulfate, seems most favored in many situations for reasons of economy."

With reference to the use of bentonite it appears from our studies that with a sufficiently high dosage, e.g., 100 p.p.m., it is possible to accomplish a degree of treatment equal to that usually obtained with the activated sludge or other biological processes, if we accept B.O.D. values ranging from 20 to 50 p.p.m. as normal figures for disposal plant effluents. Lighter dosage in situations less exacting would of course lower the degree of purification as well as the cost of treatment.

Unlike the iron salts, bentonite flocs readily over a wide range of pH values provided only that a minimum concentration of dissolved salts or other electrolyte is maintained, which in time of low alkalinity due to flood water can easily be effected by addition of lime. This minimum flocculation value for sewage in which the organic colloidal matter appears to exert a certain inhibiting action has not been definitely fixed.

[*Acknowledgment.*—The above paper, unavoidably held, was accepted for publication April 28, 1937.—Ed.]

REFERENCES

1. H. L. Olin and H. W. Peterson. J. Am. Water Wks. Ass'n, 29, 513-22 (1937).

2. Langdon Pearse *et al.* Sewage Works Journal, 7, 997-1108 (1935).

A SUCCESSFUL METHOD OF REDUCING HAZARDS AND DAMAGE CLAIMS IN WATER UTILITY OPERATION*

By T. W. COLEMAN

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The Author

THE water works operator knows the value of safety within his own organization. Loss time accidents and the medical expense of his own forces are brought directly to his attention. The injuries suffered by the public from some negligent condition of his equipment is not always brought so forcibly to his attention. Too often claims for such injuries are settled by the company's lawyer or insurance adjustor and he never learns the details of the accident. He does learn, however, that such accidents cost money and for this reason if no other, public safety should be of great importance to him.

When the waterworks operator comes to consider public safety he has a very broad field. His pipe lines, services and meters cover the whole area served by his utility. His meter and repair trucks are constantly over the whole city. His reservoirs and standpipes are attractive to small boys. His office is visited monthly or quarterly by most of his consumers, and visitors come to visit his pumping stations and filtration plant. All of this equipment and properties can and does, without proper precautions become safety hazards to the public. Of all of the equipment the curb meter and meter box appears to be the most important, from a standpoint of public safety.

Where winters are comparatively mild operators of water utilities find the use of the curb meter setting very desirable. Since the frost line is shallow there is little danger from frozen services and the curb meter is accessible at all times for readings or repairs. While the curb meter installation has these very desirable features, because of its location, there is the possibility of its becomig a costly hazard to the safety of the public.

Chattanooga Experiences

Here in Chattanooga we now have over 27,000 meter box installations. During the past ten years we have had approximately 300 lawsuits and claims for injuries suffered by reason of some negligent condition of our meter boxes. These suits amounted to several hundred thousand dollars. We fortunately did not lose all of them, many of the claims being settled quite reasonably. The cost of the first few suits made us realize, however, that we must give our attention to public safety. We learned that we must make our meter box installations safe and be able to prove them safe in the law courts.

Prior to the year 1900 people generally were not so ready to have their wrongs redressed in the law courts. Today it does not seem strange to hear some claimant say, "You can pay me or I'll sue you." When you hear him say that; you can be sure he will sue if he has any case at all. It is no secret that juries always lean toward the private citizen in his suit against a utility company. Thus we go to court to defend a suit with the juries more or less prejudiced, and the opposing attorneys fiery and venomous. I am sure my face has been very red many times in the court room listening to one of these lawsuit lawyers venting his spleen, calculated to bring us in absolute disrepute before a jury of farmers. Such men for the most part are honest and are inclined to take too literally what the witnesses and lawyers say. If the plaintiff in the case is a woman they will believe her preferably and the verdicts will be high.

Napoleon was a great general, and one of his rules was never to fight with the same enemy too often lest he learn your method of fighting and set up defenses to defeat you. There was a group of lawyers bringing these suits and they made the mistake of having us in Court too often. We learned their method of preparation and attack, and we began planning our defenses accordingly.

These suits were mostly brought to recover for injuries through stumbling, tripping or falling over a curb meter box. In the plaintiff's declarations filed in these suits, we found two allegations included in each. (1)—It is the duty of the Water Company to install and maintain its service appliances in a reasonably safe condition for the users of the streets and sidewalks of the city. (2)—The Water Company maintained said appliances in a negligent and careless manner allowing them to become dangerous, all of which is the cause of the plaintiff's injuries.

We consequently became more acutely conscious of our duty to the public to keep our equipment in a reasonably safe condition, and that we would be penalized by the courts for a failure to do so. We did not wish to be penalized and in addition had an honest desire to keep our appliances as safe as possible.

Organized Safety Program

The City Water Company of Chattanooga has always practiced safety to a certain degree. We found, however, that if we would stop losses from accidents, some form of organized safety effort would be necessary. In 1927 we formed our Safety Organization. A general safety chairman was appointed for a year with a safety committee composed of three employees, one to act as committee chairman. A new man is added to this committee each month and one is dropped, so that each member of the committee serves for three months during one of which he acts as chairman. The duty

*Excerpts from a paper presented before the joint meeting of the Southeastern Section and Kentucky-Tennessee Section of the American Water Works Association, Chattanooga, Tenn., April 5, 1937.

of this committee is to make a complete safety inspection of plant and system each month. The results of this inspection are brought up at the general safety meeting held by all department heads, foremen, truck drivers and others, at which time the points brought out by the safety committee are discussed, along with recommendations toward eliminating such hazards.

It was through the combined efforts of the members of this safety organization that we were able to reduce our public accidents from an average of forty a year, to three in 1936. It might be profitable to some waterworks operators to know how this reduction was accomplished.

The meters of the City Water Company are read once each moth. There being over 27,000 meters, each meter reader must read an average of 300 meters in eight hours. To read this many meters in the allowed time, he must move rapidly. To assist him in this work is a helper or lid lifter. The monthly visit these men make to our meter settings are the only regular inspections made of such equipment. In case of a suit or claim for injury, these men are usually the last men of the company to have seen the meter box, prior to the date of the injury. They therefore, are our most important and sometimes sole witnesses for our defense. In reading as many meters as he does it would be next to impossible for the reader to remember the condition of any one particular box. If he should happen to remember the particular box in question it is not likely the jury would give much credit to his testimony. We had to bring these men to court with some definite evidence of their having inspected the particular box in question.

In order to provide the necessary evidence we made a code sheet on which is itemized and numbered the condition of a meter or meter box which should be noticed. This code sheet has a total of twenty-one items but only six of them have a bearing on public safety. These six items cover the following conditions: Broken meter boxes, meter box should be lowered, meter box should be raised, fill in around meter box, meter box lid missing, meter box lid defective. This code sheet was attached to each field meter reading book. On each page a space is provided for listing these numbers and also the meter reader's name. When books are returned to the office a work order is made from these records of any bad condition of these boxes. These work orders are then given to the foreman of the repair crews who, after correcting the condition, returns the orders to the office where they are filed in the service records. With these records in the hands of our meter readers and repair foreman as evidence to their testimony, we are now able to successfully defend many lawsuits.

It was necessary in the beginning to school our meter readers to recognize at a glance whether or not a meter box was in an unsafe condition. To do this we made a general inspection of the meter boxes in every section of the city. We used a small movie camera to take pictures of the conditions which we wished them to recognize as needing repairs. Soon after this system was inaugurated we found, to our surprise, that meter box repair orders began to pile up. It was sometime before the bottom of this pile was reached, but when we did get to the bottom order our claims for injuries had decidedly declined. So far, we have worked over 28,000 meter box orders reported by the meter readers. A good many of these orders are repeat orders on the same meter box. In the unpaved sections of the city where the earth around the meter boxes is not supported by curb or sidewalk, a light rain will sometimes wash the earth from around the box, leaving it higher than the surrounding ground level.

What the Law Requires vs. the Court's Instructions

There is one theory of law applicable to waterworks operation in connection with the condition of meter boxes which I wish to call to your attention. It is based on the theory of actual or constructive notice. A suit against a water utility by reason of someone falling or tripping over, or stepping in a meter box or curb box is a negligence, or tort action. Before the plaintiff can recover he must show that the defective, dangerous or faulty condition causing his fall was due to the negligence of the water utility. This negligence may be an affirmative act in creating the condition complained of, or it may be a negative act, so to speak. That is, a failure to correct and remedy the said condition. It is very seldom that a complainant can prove an affirmative act of negligence. He can ordinarily only show that the condition was dangerous or defective at the time of the accident. He does not, however, have to show affirmative negligence for the trial Judge will charge the jury as follows: "Now gentlemen of the jury, even if the Water Company did not create the dangerous condition complained of, they may still be liable as it is the duty of the defendant Water Company to maintain its equipment in a reasonably safe condition. Even if some third party actually created this allegedly dangerous condition, the defendant Water Company, would be liable if it had notice of this condition. Such notice may be actual or constructive. Actual notice means of course that the Water Company through its agents or servants actually had seen or heard of the dangerous condition. Constructive notice means that the dangerous condition existed for such length of time that the Water Company would and should have known of the condition had it exercised reasonable care. What length of time is necessary, is for you gentlemen of the jury to determine after considering all the circumstances; the location of the apparatus, the density of pedestrian traffic, seriousness of the defect and its apparent danger."

This constructive notice theory is the joker in this charge. A reasonable length of time is very short when a meter box lid is missing from a meter setting on a crowded city sidewalk, while in a less traveled section, one week probably would be a reasonable time in which to make repairs in order to avoid liability. We also must depend to a large extent upon being notified by the public. The cost of making inspections of meter boxes more often than the monthly meter readings would be prohibitive. A monthly general inspection of meter boxes, by meter readers, has been held by the courts to be reasonable inspections. However, it must be effectively shown that the meter reader actually made a real inspection.

Operators of water utilities should also take notice of the fact that a pedestrian using the city sidewalks is required to use only ordinary care for his own safety. When a water utility finds it necessary to set a meter box in the sidewalk paving, it would be well for it to be sure this installation is as safe as possible for pedestrians. In this same connection, however, if this same pedestrian decides to change the course of travel and turns toward the street and injures himself on a meter box set in a grass plot between the curb and sidewalk, he is required to use a much higher degree of care for his own safety. He must be careful to look before

stepping from the pavement. This law is well settled in Tennessee by the Supreme Court, in the case of Ward vs. Western Union Telegraph Company.

Question of Contributory Negligence

The water utility often has as its defense the doctrine of contributory negligence, which bars the plaintiff's right of recovery. If a meter box in front of a consumer's premises should become in a dangerous condition and the consumer takes notice of this condition, but does nothing about it; and, later, forgetting the dangerous condition he himself is injured, he is guilty of contributory negligence and cannot recover from you for his injury. There are other ways in which the injured person may be guilty of contributory negligence, such as by any act on the part of the injured which caused or helped to cause the dangerous condition.

These general rules of law should be well understood by the waterworks operator; because, even with very able lawyers to defend him in Court, his lawyer can only show to the Court what the waterworks operator can tell him. The waterworks operator must know what information he must have in order to help prepare a defense. While the company lawyer probably should make the investigation of claims, they are often too busy to make such investigations and valuable evidence for your defense is never obtained. It is, therefore, almost imperative that the water utility make inspections of all claims and keep good clear records of these investigations.

Importance of Investigating Promptly

In making investigations of injury claims, we have found that noting the following conditions have been necessary for our protection: It is important that the first notice of an injury be recorded as to time, date, and the way notice was received. We have received such notices on the telephone, when the parties giving the notice would not give their name. In some cases the first notice we received of an injury was when suit was filed, which in most cases, is several months after the accidents causing the injury happened. In these cases the records made by the meter readers, described above, are most valuable. After notice is received an inspection of the meter box, or other dangerous condition reported, should be made. If it is a meter box, it should be carefully inspected and the following questions answered: Is the meter box set level and the top of the box flush with the surrounding ground making a continuous even surface? If not, measure and record difference, stating whether box is high, or low. Is high grass growing around box? Is the meter box or lid cracked or broken? Will the lid tilt downwardly in the box, or move when stepped upon? State type of meter and shape of meter box. Raise lid and notice if the adhering dirt or inside walls have been disturbed. Examine the earth in the bottom of the meter box for footprints, and notice the top of the meter for scratch marks. If your notice is received very soon after the accident, the above information will be helpful to you in determining whether the claim is brought in good faith, or possibly a fraudulent one. It is always a good idea when possible to have someone with you when examining the box to corroborate your testimony in case you go to Court. We have been fortunate at times in getting the consumer served by the box in question to be present during the meter box inspection. His testimony will carry more weight with the jury than that of another person from the Water Company. A rough sketch should be made showing the relative location of the meter box with reference to the curb, sidewalk, driveways and property line. A photograph of the box and its surroundings are very helpful in showing the jury the conditions you will testify to.

It is very important that the people living in the immediate neighborhood where the box is located be questioned to learn what they may know of the accident and condition of the box prior to the accident. Have them sign a prepared statement if possible. If some person is claiming injury because of a missing meter box lid, you may find a neighbor who can say that they saw the lid on the box the day of the injury, or the day before. Here you can avail yourself of the permissible defense, that the dangerous or defective condition was unknown to you and, having existed only a day or so, not sufficient time had elapsed to charge you with having had constructive notice, of said condition. Inspections of this kind are important for other reasons than planning a defense to a law suit. You will learn whether you have maintained a dangerous condition for which you are liable, and in which case you often can make a very reasonable out-of-court settlement of the suit with the injured party.

It might seem to some people that a very serious injury could not result from a meter box setting, and for this reason, I wish to touch on one of the injuries we have on record. A lady well past middle age, while walking on the sidewalk caught her heel on an open meter box and fell backward on the corner of the curb. The base of her spine struck the curb. In addition to other injuries her pelvis bones were broken. She was confined to a hospital bed ten months with weights on her feet. She never fully recovered. Her injury was permanent. Other serious injuries have resulted when pregnant women have been caused to fall by dangerous conditions of meter boxes.

Other Hazards

I have given a great deal of attention to meter box settings because they are more potential hazards to the public safety than other pieces of waterworks equipment. There are other waterworks activities in which safety precautions should be taken to prevent injury to the public.

In laying water mains and services trenches naturally should be guarded with a safety horse well lighted with red lanterns at night. If this trench is in a highway or street with heavy traffic it is wise to employ a watchman to see that the red lights are kept burning. If the job is too small for the employment of a watchman a request to the police captain of the district will often result in police look-out for you.

Another source of public injury accidents is the automotive equipment operated by the water utilities. This class of accidents has been highly publicized. In every magazine or trade journal much has been written on the proper way to handle an automobile. Safe driving instructions are important points in safety education. All drivers should be schooled on these points. Safe driving should be second nature to him, but in addition he should be taught to recognize defects in his equipment. It is necessary for the water utility to school its drivers also in what to do after the accident happens.

It has been my personal experience that safety education, together with organized safety efforts, will reduce accidents and damage claims against almost any water utility.

(Mr. Coleman's paper also recited experience with organized racketeering in damage suits brought against his company.)

Members of the A. S. W. A. at the Phoenix Plant.

CHEMICAL TREATMENT FEATURED AT ARIZONA SEWAGE MEETING*

By A. M. RAWN†
Associate Editor

CENTURIES ago, long before the advent of white men in Arizona, the valleys of the Salt and Gila Rivers supported a population of 100,000 red citizens of a former nation who farmed the fertile valleys with the aid of irrigation. This people perished or moved away and abandoned their productive farms which were promptly reclaimed by the desert, and most traces of the former civilization were eradicated.

Years after the Spaniards first treked over and explored the arid wastes, the hardy Morman pioneers moved south from Utah and once again began the job of reclamation, surprised somewhat to find themselves building canals where there was ample evidence that canals had existed years before in a period lost to history; found themselves in fact, re-excavating irrigation ditches which had been once constructed with stone spades and picks.

The progress since the first white settlers commenced their work in the middle of the Nineteenth Century is history; suffice to say that a quarter million acres of these valleys are again green and fertile, constituting one of the greatest engineering triumphs in the world, surrounded by the best and most modern safeguards against destruction known to science, and in the very heart of this district lies Phoenix, capital city of Arizona.

Why did the red men perish or leave? Science ascribes it to several causes, among which stands prominently a lack of sanitation. Disease and pestilence, following upon the heels of overcrowding and perhaps accentuated by drouth and crop failures in lean water years, probably contributed to the decimation of a great agricultural people and drove them to destruction.

All of which brings us to a group of men in Arizona today whose knowledge and efforts constitute one of the scientific safeguards against the repetition of such destruction as overtook the red men. We refer to the Arizona Sewage Works Association in its Annual Meeting in Phoenix. Smallest of any of the Federated Associations, its members are doing a great job of sanitation in the state and particularly in the environs of Phoenix. Thirty-two members and guests registered at the meeting, including in the roster representatives from California, Utah, Colorado, Nevada and Oregon.

The morning session was devoted to a caravan to the Phoenix activated sludge plant, the Glendale chemical precipitation plant and the Tovrea Packing Company's chemical precipitation plant. At luncheon the group was addressed by William O'Connell of Wallace & Tiernan on "Advancement in the use of Chlorine in Sewage and Water Treatment." President John Carrollo turned the afternoon session over to Dario Travaini, Supt. of the Phoenix plant, who led an informal discussion of plants visited, operators' problems, general conditions of sanitation in Arizona, New Mexico, Utah, Colorado and Washington. During the course of the meeting Harold Gray of Berkeley, Calif., described innovations at a large number of Eastern works and gave a general resume of the New York Sewage Works Association meeting in January.

"Modern Uses of Chlorine in Sewage Treatment"—MR. O'CONNELL stated that the greatest recent advancement in the application of chlorine and its salts to sewage is the widening horizon of its use. Simple, fundamental facts are rapidly becoming well known to the engineer and operator and this knowledge, applied to the complexities of sewage treatment, is being more widely used and constantly developing new fields of application; that chlorine in some form has become the handy tool in sewage treatment is increasingly evident.

Mr. O'Connell then developed the chemistry of chlorine as applied to sewage, stating that while reactions could not be explained in simple terms or be easily described, the manifestations were obvious to the investigator; that wherever sterilization, reduction in B.O.D. or stability of sewage or effluent were desired, chlorine had a place in the picture. The speaker touched upon other uses of chlorine, noting that bulking of activated and digesting sludge had yielded to chlorine applications, that it was useful in trickling filter operation and con-

*(This report, condensed from a fuller one by Mr. Rawn, was scheduled for our June issue, but prior commitments necessitated carrying it over to this issue.—Ed.)

†Ass't Chief Eng.—Los Angeles County Sanitation Districts.

Left to Right: W. J. O'Connell, San Francisco (Luncheon Speaker). John Corollo, Phoenix (President of the Association). Ben McMorrow, Phoenix (Secy.-Treas. of the Association).

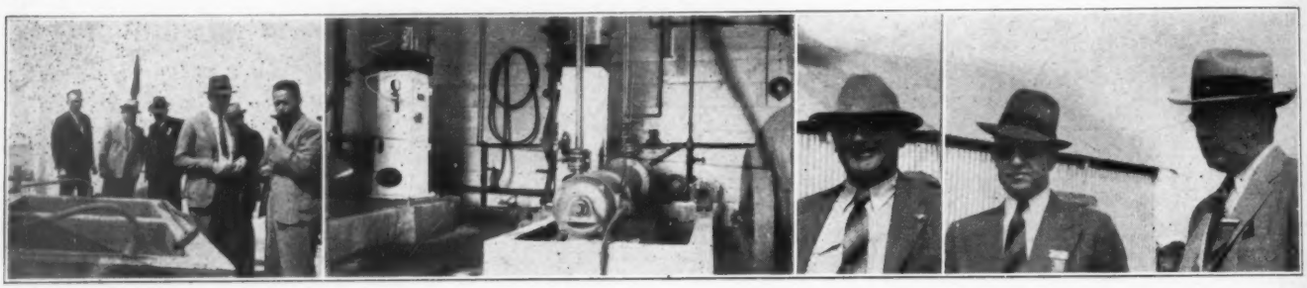
cluded with a discussion of the properties of iron chloride salts and their use as sewage deodorants and precipitants.

Interesting among O'Connell's statements was one to the effect that the overall solids reduction in sewage, incident to precipitation with Ferric Chloride, was at times greater than the original suspended solids content, indicating a coagulation and precipitation of truly colloidal solids in addition to the nonsettling suspended particles. This evidence was substantiated in recent investigations at the Tovrea Packing Plant in Phoenix. The speaker further stated that the reduction in B.O.D. attained by chemical precipitation with Ferric Chloride could not be accounted for entirely by solids reduction but must be in part, attributed to rendering certain organic solids less fit, if not actually unfit, as bacterial food.

fluent from the final basin is chlorinated and discharged to the Salt River. Sludge is digested in two stages, the primary tank being 55 feet in diameter and the secondary 40 feet; both are of 20-foot water depth—the primary having a fixed cover and equipped with two Turbo-Mixers; the secondary with a gas holder cover. Sludge gas amounting to 15,000 to 18,000 cubic feet per day is utilized in part to maintain sludge temperature at 85° F. and will eventually all be used in soap and molasses manufacture. Ferric Chloride is manufactured on the ground, the iron content being hay baling-wire formerly thrown on the city dump. Lime or sulphuric acid is used to aid precipitation at times.

Operation costs including all labor, materials and supplies amount to $18.00 per day. From salvage of grease and sale of digested sludge for fertilizer the plant is now returning its owners $20.00 per day. And, when full gas utilization is adopted it is estimated that the works will show a net daily return of $6.00 which may be applied to interest, and amortization to make the plant entirely self-supporting.

"The Glendale Chemical Precipitation Plant," was described by CHARLES HICOCK, Water Superintendent, and Marshall Roach, Sewage Operator. This plant, designed by Headman-Ferguson Engrs., is located some miles from the town of Glendale, and treats a flow of 500,000 gallons per day. Sewage as it reaches the plant is rankly septic but yields to treatment readily. In general, the plant incorporates a Ferric Chloride generating plant, dosing and mixing chambers, flocculation and sedimentation tanks. Sludge is digested without temperature control and the digestion tanks, placed in ser-



Snapped on the Inspection Trip

(1) *At the Ferric Chloride Generating Tanks, Glendale's Chemical Precipitation Plant.* (2) *The Chlorine Control Room, Tovrea Packing Co.'s Chemical Treatment Plant.* (3) *Dario Travaini, Supt. Sewerage, Phoenix.* (4) *Howard Hurst, Acting State San. Engr. of Utah, Salt Lake City, and B. Y. Howe, State San. Engr. of Colorado, Denver.*

"The Tovrea Packing Company's Chemical Precipitation Plant," by JOHN CAROLLO, Consulting Engr., Phoenix, Ariz.

Mr. Carollo, president of the Arizona Association and designer of the Tovrea works, explained that this chemical precipitation plant was constructed to relieve the pollution load in the Salt River, stating that the addition of 20 to 24 grains of iron chloride per gallon to the raw waste effects a removal of 80 to 85 per cent B.O.D. or from about 4,000 p.p.m. to less than 800. Total solids removed from the daily average flow of about 200,000 gallons amount to 7,000 pounds and at times the removal exceeds the total suspended solids content of the raw meat packing waste.

At this plant the raw waste carries the entire plant refuse including all paunch manure, total solids at times reaching 12,000 parts per million on 24-hour composite. The waste flows past a bar screen (1-inch opening) through a mixing chamber where Ferric Chloride is added; thence through a 16 by 19 ft. flocculation chamber (6 ft. deep) to a final sedimentation chamber 16 feet wide, 55 feet long with 8-foot water depth. Effvice last August, have not as yet produced any well-digested sludge. The process effects a reduction of 75 per cent in suspended solids content. Effluent is discharged into New River, which most of the year is a dry wash.

"The Phoenix Activated Sludge Plant," was described by DARIO TRAVAINI, Superintendent of Sewers and Disposal, Phoenix. The works, erected in 1931, are designed to treat a flow of 15 million gallons daily, the present daily average being 10 m.g.d. Sewage at the plant passes through a detritor into a primary settling chamber; thence into aeration channels equipped with Dorr paddles and diffuser plates. Final setting is obtained in a single 140 ft. square clarifier. Effluent is chlorinated and, pending the outcome of claims for prior rights thereto by owners, is run to waste. It is the ultimate proposal to sell the water for irrigation. Digested sludge is disposed of as fertilizer.

The operators' discussion included brief descriptions of sanitary facilities at Prescott, Holbrook and Wickenburg, as well as general remarks concerning activities in bordering states.

Comments by the EDITOR

Air-Conditioning

ONE cannot dodge the necessity of looking the problem of ample water supply and sewerage facilities for rapidly growing air-conditioning squarely in the face, if the future is to be free from serious embarrassment to water works and sewerage authorities. The general lack of concrete information in the hands of water supply managers, relating to air conditioning installations now being served by their systems and the effect as to demands on local water supply facilities, is not a wholesome situation. Such lack of information, resulting in what appears to be a technically unsound position of American water supply industry on the whole, was brought into the open during the recent Convention of the American Water Works Association.

Aside from the first question—Are the water supply facilities adequate, and are they to be kept so, in order to supply the most practical means of cooling in air conditioning?—emphasis was also placed on a second, and important, problem to be met; namely, the question of sewerage facilities capable of handling the increased loading to be imposed, the form of spent water discharged from cooling equipment, on sewers not designed for such unanticipated service. The last is brought forcibly to attention because of basement flooding experiences in Chicago due to surcharging of inadequate sewers. Also there is an attendant pumping and treatment problem to be considered, even though sewer capacity should be adequate to take the peak loadings of spent water. In brief, then the problem of water usage in air-conditioning becomes one for the sewerage authority as well as the water utility. To preclude shortcomings due to either "link of the chain" being found too weak to serve for the greatest good and comfort of the community, future facilities must be looked upon as a public service as well as a utility service. In this matter appears another bit of evidence indicative of the fact that it is becoming increasingly difficult to consider water supply and sewerage as other than inter-dependent public services. With trends toward garbage disposal by grinding and flushing it into sewers and the added air-conditioning problem, involving temperature increase of sewages (more rapid septization) and volume loading of disposal facilities, sewerage authorities have something in the way of a package of import laid on their door-step also.

Looking back at what developed from papers and discussion at the A.W.W.A. convention (reported elsewhere in this issue) a contribution of high value came from the Chicago Water Department, through City Engineer Loran D. Gayton, who presented the most valuable information thus far revealed in actual studies and predictions concerning water demands and sewer capacities. Chicago has evaluated and plotted its study records covering the whole of the central business district and, in particular, individual zones of concentrated air conditioning. In the process 700 records, revealing 24 hour flow characteristics, were made available for block by block comparisons and analyses. Such information, together with data on the types of air-cooling equipment and tons of refrigeration capacity (ice tonnage equivalents being used as the common unit in specification and sales), enabled Mr. Gayton to show that installed air conditioning capacity had increased 35½ per cent during the year 1935-1936. That during the same period, water sold to air-conditioned premises had increased 38 per cent.

More interesting to water works managers than the 38 per cent increase in annual consumption are the Chicago figures revealing peak demand 130 per cent above the daily average for a district which is now but 16 per cent air conditioned. Further, July and August demands per 24 hours in zones most densely air conditioned reached 170 per cent of the annual average. Compared with this was the 10 per cent over average for non-conditioned premises during the same two months. In the block of most concentrated air conditioning (theatres, hotels, restaurants) maximum per day reached 250 per cent of the average.

Chicago's study reveals that its major mains and pumping capacity seem sufficient for 10 more years of anticipated air conditioning growth at recent rates. On the other hand, deficiencies of sewers was something to be coped with, and Mr. Gayton also pointed out the need for enlargement of the smaller mains in order that pressures might continue adequate under anticipated air conditioning growth at or near present rates. Taking into consideration the very great expense involved in major enlargements of supply facilities and sewer reconstruction, in looking ahead, it seemed more logical to forego the inviting income and save major expenditures by requiring air-conditioners to install the less wasteful evaporative-type cooling devices. Twenty years hence such would result in a reduction of the anticipated maximum of 295 M.G.D. to a 15 M.G.D. demand for cooling in Chicago—calculated on the basis of 95 per cent water reusage.

From statistical information on air-conditioning, gathered in recent surveys for the U. S. Bureau of Foreign and Domestic Commerce, O. C. Holleran of Washington, told members of A.W.W.A. that since 1933 air-conditioning installations had increased 1400 per cent, and were increasing at a steeper rate each year. Since 40 per cent of these depended upon public water supply for operation, the connection between available city water supply and air conditioning growth had been proving a matter of increasing consequence. Yet, one of the remarkable facts developed, in the recent survey of important municipalities, was the lack of concrete or detailed knowledge of the situation existing in their communities which water authorities had been able to contribute.

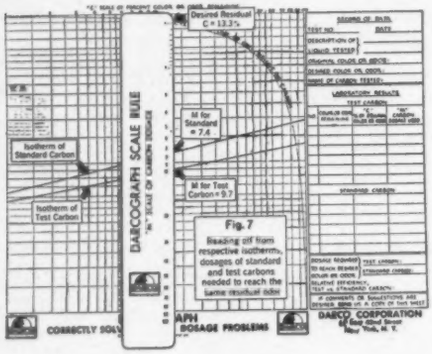
Only with such information as that gathered by Chicago and a handful of others, can managers and engineers know with any degree of assurance the need for water regulation, or what limitations to place on usage. Without concrete information, estimations are purely guess work; and, action based on such may place the water department in quite an embarrassing position if water use for air conditioning is restricted or refused, without sufficient proof of inadequacy of supply or delivery facilities, or while others are allowed free use. Furthermore, it would seem that every water works and sewerage manager should be in a position to answer the inescapable question—"What will it require and how much will it cost the city to provide adequate supply and/or sewer facilities?"

EQUIPMENT NEWS

The "Darcograph"

The "Darcograph" comes as a contribution of the technical staff of Darco Corporation—manufacturers of powdered and granular "Hydrodarco" activated carbon, especially designed for water purification.

The illustration pictures a graph sheet, for entry of data, and the specially designed "Scale Rule" used with the graph. The combination is used in determining the effectively correct (non-wasteful) carbon dosage for existing conditions and attainments sought. For comparing two or more carbons, use of the "Darcograph" is suggested. Use of the graph and rule is explained in an accompanying booklet which discusses the method and gives explicit directions, with explanatory case examples. Procedure in making laboratory tests to provide data for plotting is carefully given, as is the making of the important threshold odor tests.


DARCOGRAPH SCALE RULE
Desired Residual C = 13.5%
M for Standard = 7.4
M for Test Carbon = 9.7
Isotherm of Standard Carbon
Isotherm of Test Carbon
Fig. 7
Reading off from respective isotherm, dosages of standard and test carbons needed to reach the same resultant odor
DARCO CORPORATION

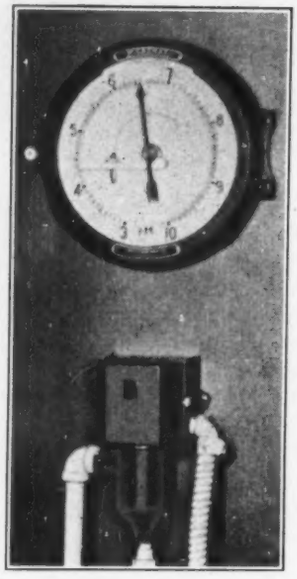
The Darcograph

With the thought of giving water treatment men something more scientific than the trial and error methods, usually resorted to, the "Darcograph" has been evolved. Although based on a modification of involved equations, applying to general absorption, the user of the graph is spared the involved computations. A "Darcograph" set, including book of directions, a pad of graph sheets (illustrated) and hard-wood scale rule, is available without charge to any who request the set from Darco Corporation, 60 East 42nd St., New York City.

▼

pH Indicating, Recording and Controlling "Micromax"

The accompanying illustration pictures one of the pH indicating dials in the new Springfield, Ill., Water Purification plant. With a glance at the sweep hand of the "clock" the operator determines whether the lime dosage is the correct one. Also, on another instrument is revealed the pH resulting from recarbonation. Operators at Springfield no longer have to take frequent routine samples to determine correctness of treatment. Hand recording of values is no longer needed because the Leeds and Northrup "Micromax" does the recording on a chart (behind the hand) for the benefit of the superintendent and relief of the operator. In other plants, "Micromax" functions also to automatically alter the lime or carbon-dioxide applications in maintaining pre-selected pH values.



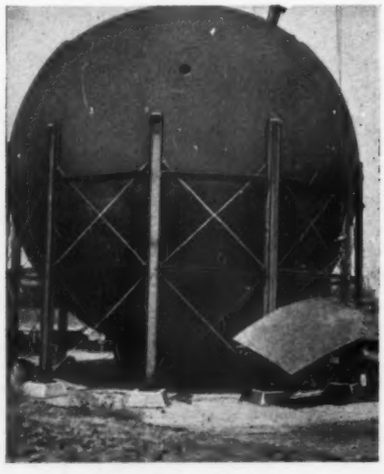
pH Indicating, Recording, Controlling Micromax

"Improving Corrective Water Treatment" is the caption of a new 20-page illustrated bulletin, describing "Micromax" equipment, and its operation and usefulness in manual or automatic control. For a copy address Leeds and Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

▼

Graver Gas Holder

Not generally known is the fact that Graver of Chicago and Catasauqua, Pa., fabricates gas-holders as well as tanks, pressure filters and softening units. Better known perhaps in the industrial than the municipal field, Graver does a variety of standard and special construction involving steel plate fabrication. The above picture is of a 48 ft. diam. gas storage pressure-sphere, designed for 20 lbs. working pressure. For further information on Graver tanks et al. request bulletins of Graver Tank and Manufacturing Co., Chicago, Ill.



Graver Gas-Holder

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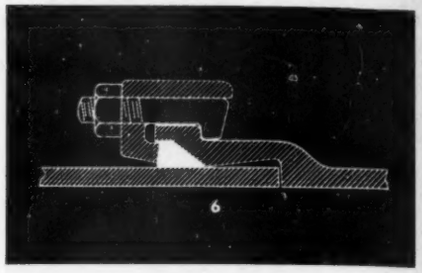
Carson Joint Clamps

The Carson mechanical gasketed joint is not new, but the improved clamp and bolt arrangement is probably new to most of our readers. The illustration pictures the improved cast-iron follower which shields the improved corrosion resistant (pearlitic) charcoal cast iron bolts. The gasket is of compounded rubber. The joint assembly comes in one style for use on new pipe as laid (4 to 48 in.), and in another (split) style for use on pipe lines already in service. For descriptive literature address, Carson-Cadillac Corp., 1221 Pinson St., Birmingham, Ala.



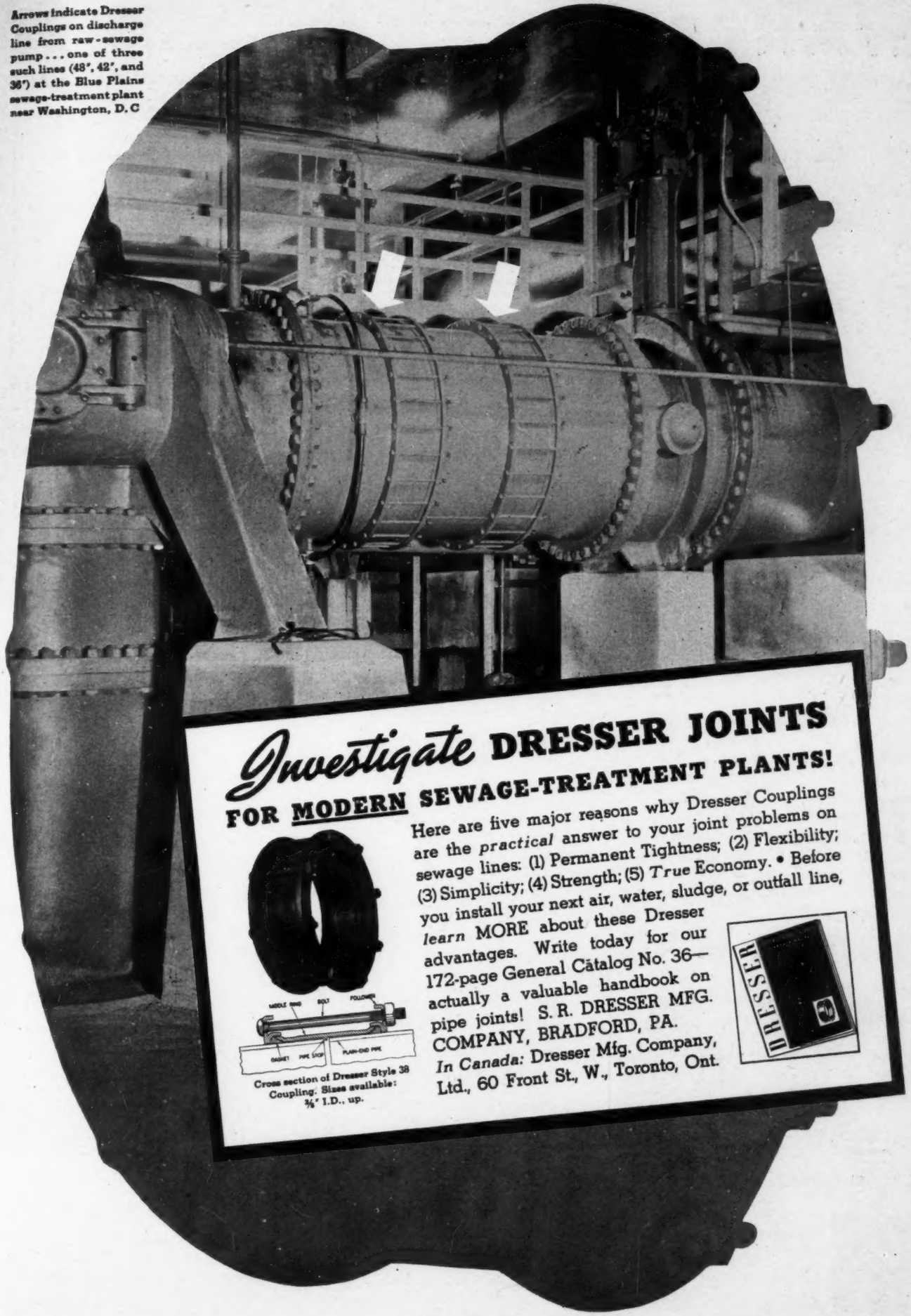
Carson Clamp

▼

Improved Adjustable Wrenches

New "Adjustable" and "Superjustable" Wrenches have been announced by J. H. Williams and Company of New York City. Both embody new design features, one being the square shoulders on the movable jaw shank to give a more positive bearing and also overcome the commonly experienced spreading and welding action of conventional wrenches. The "web" is thicker and stronger without increased head thickness. The "Superjustable" line of wrenches are forged from chrome alloy steel—are thin, light, strong, well balanced. The finish is rust-proof chrome-plate polished at the head and satin finished at the handle. Both types are available in 5 sizes (4, 6, 8, 10, 12 inches). For descriptive pamphlet "Adjustable Wrenches" address, J. H. Williams & Co., 76 Spring St., New York City

Improved Adjustable Wrench



Arrows indicate Dresser Couplings on discharge line from raw-sewage pump . . . one of three such lines (48", 42", and 36") at the Blue Plains sewage-treatment plant near Washington, D. C

Investigate DRESSER JOINTS

FOR MODERN SEWAGE-TREATMENT PLANTS!

Cross section of Dresser Style 38 Coupling. Sizes available: ¾" I.D., up.

Here are five major reasons why Dresser Couplings are the *practical* answer to your joint problems on sewage lines: (1) Permanent Tightness; (2) Flexibility; (3) Simplicity; (4) Strength; (5) *True* Economy. • Before you install your next air, water, sludge, or outfall line, *learn* MORE about these Dresser advantages. Write today for our 172-page General Catalog No. 36—actually a valuable handbook on pipe joints! S. R. DRESSER MFG. COMPANY, BRADFORD, PA.

In Canada: Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

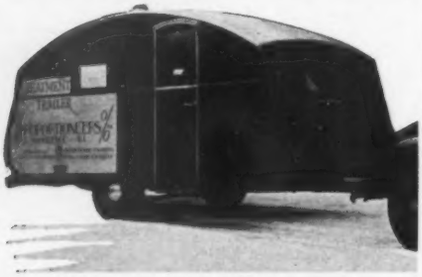
WANTED

INFORMATION REGARDING WHEREABOUTS OF THIS MAN. Left % Proportioneers % office, Providence, R. I., March 15th, with Treatment Trailer.

Has been reported seen at Florida Section A. W. W. A., Ocala, Fla., at Kentucky-Tennessee and Southeastern A. W. W. A. sectional meetings, Buffalo A. W. W. A. Convention and other such gatherings. Apparently apt to show up at water works offices almost anywhere.

Should you locate JEFF CORYDON in your city, be sure you let him show you the modern way of feeding chemicals, with chemical feeders he has on display in his

TREATMENT TRAILER



% PROPORTIONEERS % Inc.

Associated with Builders Iron Foundry

9 N. Codding Street

PROVIDENCE, R. I.

WITH THE MANUFACTURERS

Mathieson Alkali Personnel Changes

The Mathieson Alkali Works, manufacturers of chlorine, ammonia and caustic, announce the following personnel changes of interest.

Robert M. Mannheim has been made New England district manager, with headquarters in the Hospital Trust Bldg., Providence, R. I. For the past six years he has been a member of the Mathieson organization and is well known in Northern New Jersey territory covered recently by him.

R. M. Mannheim

J. R. Harrington

James R. Harrington who has been covering the New York metropolitan area for some time has been appointed to Mr. Mannheim's old territory. He is a graduate of Washington University (St. Louis) and came to Mathieson Alkali from the National Lead Co. To take over Mr. Harrington's territory, in the New York area, Donald G. Ross has been appointed from the New York office staff.

▼

Fuller Co. Makes Sayre Chicago Manager

Howard S. Sayre has been appointed manager of the Chicago office (1118 Marquette Bldg.) for Fuller Company of Catasauqua, Pa., manufacturers of pneumatic systems for handling fine grained or pulverized materials, such as cement and chemicals; also, rotary compressors and vacuum pumps. Mr. Sayre has for a number of years been connected with the home office of the Fuller Company on sales and engineering work. Best known of Fuller equipment in the water works and sewerage field is their "Airveyor" system for "laborless—dustless" unloading, storing and distribution of chemicals purchased and handled in money-saving bulk form.

▼

"Cloroben" in Reverse Becomes "Benoclor"

Since the introduction of *soluble* "Cloroben" for deodorization of privies, septic tanks, and the like, some confusion has arisen between the initial (insoluble) product "Cloroben" and the newer soluble "Cloroben." To correct this situation the Cloroben Corporation of Jersey City, N. J., has announced a "reversion" which changes the name of the insoluble product to "Benoclor." The new product is being used by sanatoria, hotels, camps; the latest camps being that of the Boy Scouts of America during the National Jamboree in Washington.

Announcing
The New EVERSON
Type "R" Chlorine Feeder

HERE at last is the perfect chlorine feeder featuring the exclusive EVERSON *micro-control*, absolutely accurate feature, combined with the other proven EVERSON features including: Automatic Gas Absorber, Automatic Venting, and the Automatic Vacuum Break which protects against Back-Flooding.

EVERSON can supply capacities for every need—from small water works and swimming pools, to large sewage treatment plants.

Write for New Bulletin

EVERSON MFG. CO.
"The Swimming Pool People"
233 W. Huron St., Chicago, U. S. A

▼

Crane Establishes Valve and Fittings Dept.

Announcement has been made by P. R. Mork, vice-president in charge of sales, Crane Company, of the establishment of a new department — the Valve and Fittings Department. This move brings about a co-ordination of all activities pertaining to estimating, engineering and sales of valves, fittings, pipe. W. H. Pape, as manager of the new unit, has been connected with Crane Co. since 1927 and recently headed the Oil Sales Department. Comprising one unit of the new Valve and Fittings Department is the Water Works Section, headed by W. A. Dallach.

W. H. Pape, Mgr.

WATER WORKS ENGINEERS APPRECIATE THE MIRROR-LIKE SURFACE BARRETT WATER WORKS ENAMELS PROVIDE

Barrett

WATER WORKS
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FIELD SERVICE

The Barrett Company maintains a Pipe Line Service Department to assist engineers in all coating problems, and also has available Field Service men whose assistance is offered where Barrett's protective coatings are used. Inquiries are invited.

THE BARRETT COMPANY

40 Rector Street **New York, N. Y.**

Water Works and Sewerage—July, 1937

HEADACHE PREVENTIVE

FOR

Water Works Engineers!

. . . the headaches that come from pipe joints that don't stay tight—from streets that must be torn up to fix leaks—from expense that wasn't covered in the estimate.

- The Preventive is MINERALEAD. It makes joints permanently tight. It is easily worked, with unskilled labor. Doesn't mind the sudden storm which would spoil jointing compound not in the *ingot* form.
- Joints made with MINERALEAD stand vibration, even under railroad tracks, and on bridges crossed by heavy freight traffic.
- MINERALEAD is not only DEPENDABLE, but so easy to work that it is ECONOMICAL as well.

MINERALEAD

for Jointing Bell & Spigot Pipe

For money-saving information, write

The ATLAS MINERAL Products Company of Penna.

MERTZTOWN - - PENNSYLVANIA

Our FORTY-SIXTH YEAR

MEETINGS SCHEDULED:

July 21-24—DETROIT, MICH.
American Society of Civil Engineers. (Annual Convention). Sec'y, George T. Seabury, 33 West 39th Street, New York City.

Aug. 18-20—DEARBORN, MICH. (Dearborn Inn).
Central States Section A. W. W. A. (Annual Meeting). Sec'y-Treas., H. Lloyd Nelson, 2437 Koppers Bldg., Pittsburgh, Pa.

Aug. 26-28—WILMINGTON, N. C. (Cape Fear Hotel).
North Carolina Section A. W. W. A. (Annual Meeting). Sec'y-Treas., A. R. Hollett, University of North Carolina, Box 281, Chapel Hill, N. C.

Sept. 13-14—SAN JOSE, CALIF.
California Sewage Works Association. (Ninth Annual Convention). Sec'y-Treas., R. R. Ribal, 701 City Hall, Oakland, Calif.

Sept. 20-22—SANTA FE, N. M. (LaFonda Hotel).
Rocky Mountain Section A. W. W. A. (Annual Meeting). Sec'y-Treas., B. V. Howe, State Sanitary Engineer, State Office Bldg., Denver, Colo.

Sept. 21-24—POLAND SPRING, MAINE (Poland Spring House).
New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Building, Boston, Mass.

Oct. 4-6—ATLANTA, GA. (Atlanta Biltmore Hotel).
American Public Works Association (Congress). Executive Director, Frank W. Herring, 850 East 58th St., Chicago, Ill.

Oct. 4-5—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
Conference of State Sanitary Engineers. (Annual Convention). Sec'y-Treas., R. E. Tarbett, U. S. Public Health Service, Washington, D. C.

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
American Public Health Association (Annual Convention). Executive-Secretary, Dr. Reginald D. Atwater, 50 West 50th St., New York City.

Oct. 13-15—ATLANTIC CITY, N. J. (Haddon Hall).
Pennsylvania Water Works Association. (Annual Meeting). Sec'y, Dr. F. Herbert Snow, 327 Telegraph Bldg., Harrisburg, Pa.

Oct. 15-16—ELMIRA, N. Y. (Hotel Mark Twain).
New York State Sewage Works Association. (Fall Meeting). Sec'y-Treas., Arthur S. Bedell, State Dept. Health, Albany, N. Y.

Oct. 18-21—AUSTIN, TEXAS (Driskill Hotel).
Southwest Section A. W. W. A. (Annual Meeting). Sec'y-Treas., L. A. Quigley, Superintendent Water Dept., Fort Worth, Texas.

Oct. 18-21—NEW ORLEANS, LA. (Hotel Roosevelt).
International City Managers Association. Executive-Director, Clarence E. Ridley, 850 East 58th St., Chicago, Illinois.

Oct. 19-20—CINCINNATI, OHIO (Netherland Plaza Hotel).
Ohio Conference on Sewage Treatment. (Annual Convention). Sec'y, Bruce M. McDill, Dept. Health, Columbus, Ohio.

Oct. 20-23—SACRAMENTO, CALIF. (Senator Hotel).
California Section A. W. W. A. (Annual Convention). Sec'y-Treas., C. M. Hoskinson, 1140, 43rd St., Sacramento, Calif.

Oct. 28-30—ST. PAUL, MINN. (St. Paul Hotel).
Minnesota Section A. W. W. A. (Annual Meeting). Sec'y-Treas., R. M. Finch, 416 Flour Exchange Bldg., Minneapolis, Minn.

Nov. 3-5—AMES, IOWA.
Iowa Wastes Disposal Association. Sec'y-Treas., L. J. Murphy, Ames, Iowa.

Nov. 4-6—RICHMOND, VA. (Hotel Jefferson).
Virginia Section A. W. W. A. Sec'y-Treas., H. W. Snidow, Senior Assistant Engineer, State Dept. Health, Richmond, Va.
(A "Home Coming" meeting in honor of Virginia's President of A. W. W. A.—Gene Dugger.)

CATALOGS AND LITERATURE RECEIVED

[Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.]

"American Rotary Distributors"—In two new bulletins are described and illustrated the two distinctive styles of "American" Rotary Trickling Filter Distributors produced by the American Well Works Company. The "reaction type" (self-propelling type) is offered for installations wherein the filter diameter is less than 100 feet and where head available is not on the border line, for dependably effective operation at all times. Unique, are the three distributor arms used on this self propelling distributor to reduce weight, produce balance, negative the wind action, start quickly, and rotate easily under minimum heads—all shown in theory and later confirmed in actual field performance. Fifteen installations are listed (some pictured); specifications are given and details discussed and pictured. Helpful diagrams and a filter loading chart are appended.

The second new bulletin just as effectively describes "American" Power Driven Distributors, which are motivated by a motor enclosed in the head of the center post. These units are especially recommended for plants without dependable or sufficient head; always, for the larger units of 100 ft. diameter and larger. The orifices in the distributor arms point vertically downward to a splash onto a distribution plate. Pertinent features of this type distributor are given in considerable detail—amplified with many illustrations and line drawings. Appended is an impressive listing of 47 installations at 28 plants (2 being for treatment of industrial wastes) and a useful "Loss of Head Table for Fittings, Valves, etc." appears.

For these companion bulletins No. 230 and No. 231, address The American Well Works, Aurora, Ill.

"Hydrauging"—Is described, as are the new models of the "Hydrauger"—a mechanical "gopher" for boring pipe holes under paved streets, highways, railroad right of way, lawns, etc., at costs averaging 1/10th that of pavement cutting, trenching, back filling, settling and repaving. The improved (compressed air driven) Hydrauger (Model 2A-2X) is a more powerful unit for faster and straighter horizontal boring and reaming. It is claimed that bores between 2.5 and 14.5 inches diameter have been made for distances up to 175 feet, in some cases saving the cost of the machine in a single job. Especially useful is the clean, uniform and straight bore when pushing through rock, the bulletin citing 10 minutes per foot through limestone formation and 40 ft. per hour through ordinary soils with an 8.5 in. hole. For a copy of the new "Hydrauger" Bul. No. 5, address Hydrauger Corp., Ltd., 116 New Montgomery St., San Francisco, Calif.

"Aeration of Sewage and Water"—Is the caption of Carborundum Company's Engineering Bulletin No. 1, now in its third edition. In orderly style and illuminatingly illustrated, it cites the several applications of porous tubes and plates in activated sludge, bio-flocculation, flash mixing, chemical precipitation, grit washing, chlorination, sludge conditioning, etc. In water treat-

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Water Conditioning

ment—aeration, odor expulsion, mixing and flocculation, re-carbonation in softening. Then is discussed plant design, with typical schemes illustrated, and some space is given to properties of "Aloxite" diffusers, methods of testing, installation, operation, maintenance. Appended are standard specifications, as a guide, and a bibliography. Enough has been said to indicate the value and usefulness of this 30 page bulletin to engineers, superintendents, chemists, or contractors concerned with study, design, construction or operation of water and sewage treatment plants. For a copy, address The Carborundum Co. (Sanitary Div.), Niagara Falls, N. Y.

"Locating Leaks"—In a new booklet, captioned "The Modern Way," Water Leak Detector Co. of Columbus, Ohio, tells in pictorial fashion how modern leak location is accomplished by "Measured Sound" brought in by the uncanny Universal Leak Detector, which by radio principle converts leak vibrations into sound intensity. This booklet picturizes the equipment and, by diagrams, illustrates its application to specific problems involving the questions "Where are the leaks?" —and, "Approximately how big is it?" in general reconnaissance, or block by block surveys. Models listed run from the "Heavy Duty" (super amplification type) to the "Midget" for nearer-by leaks, and for use of meter readers. Also described are the Universal Pipe Locator Attachments, serviceable in connection with all models. For a copy of "The Modern Way with a Universal," address Water Leak Detector Co., 155 No. Third St., Columbus, Ohio.

"Taste and Odor Control with Activated Carbon" —Is a new and enlarged edition (80 pages) of an earlier publication, of the same title, distributed by the pioneering manufacturers of water works powdered carbon—"Aqua Nuchar." It is a veritable history of the use of powdered carbon in water purification; describing and illustrating methods of application; citing experiences of grateful users all over the country; evaluating and recommending points and methods of application; dosages for various purposes. Methods of making and evaluating odor tests and odor control procedures (emergency and routine) are given. In the appendix appear useful conversion tables and factors. The present day operator and manager, seeking to produce a palatable water, would do well to study this "handbook" on activated carbon treatment. For a copy address Industrial Chemical Sales (Division of W. Va. Pulp and Paper Co.), 230 Park Ave., New York City.

"Reilly Pipe Coatings"—Are described in specifications covering the special water works and sewerage coatings offered for pipe protection by Reilly Tar and Chemical Corp. Involved are two all tar-base enamels No. 230-A and No. 230-H with primers for each; also, "Reilly Filled-Pitch Coating and Primer." Accompanying is also a description and specifications covering "Reilly Sewer Jointing Compound No. 550" of trowelling consistency for placement in wet trench without melting, or use of runners; or, for hot pouring in dry trench. For a copy of "Reilly Coating and Joint Compound Specifications" address Reilly Tar and Chemical Corp., Merchants Bank Building, Indianapolis, Ind., or 1201 Architects Bldg., Los Angeles, Calif.

"Water Controlling Equipment"—Is described and illustrated in a new 48 page catalog covering the Mueller-Columbian line of sluice gates, shear gates, flap valves, drain valves, low pressure gate valves, check valves, etc. Detailed specifications, diagrams, installation instructions and pictures of actual installations are presented. Stand brackets and stem guides are also illustrated. There is a page of discussion of hydraulic operation for sluice gates and gate valves; and, numerous typical installations are diagramed for the purposes of rendering assistance to operators, or engineers planning water supply projects or improvements. For a copy address Mueller Company, Decatur, Ill., or Chattanooga, Tenn.

"Norit"—Is the caption of a pamphlet from the American Norit Company, manufacturers of "Norit" activated carbon for water purification. It recites the history behind "Norit" and presents its specific qualities; also, actual experiences and accomplishments of the carbon in American plant practice. Stressed is the guaranteed high efficiency and phenol absorption value of 15, as reported by authoratively signed recent laboratory tests. For a copy of this pamphlet, address the "Norit" sales agents, L. A. Solomon & Bros., 216 Pearl St., New York City.

"Dewater by Centrifuge"—The American Centrifugal Corporation presents design, characteristics, and construction details; describes operation and cites results of dewatering sewage sludges and screenings with the new American Centrifuge. Installations at Collingswood, N. J.; Niagara Falls, N. Y.; Toronto, Ont., and New York City are cited—all operating without chemical conditioning. Appended is a report of an engineering firm on operating tests made on two installations. For a copy address American Centrifugal Corp., 115 Broadway, New York City.

"Improved Automatic Pump Controls"—Are described in new catalog insert-leaflets from Automatic Control Company of Minneapolis. In Bulletin T-3 the new Types R and S Tanktrols, for two pump control, are presented. The first involves a static pipe line connection between pump house and nearby tank. Type S is for control of elevations in distant tanks, but functions from pressures on the discharge line at the pumps. Improvements involve a simplification of control mechanism and avoidance of special equipment heretofore needed. Bulletin T-4 describes the new "Tanktrol Pressure Switch" designed to meet a demand for a high grade pressure switch, possessing great sensitivity and wide pressure differential adjustments. Involved is the improved thermal surge-snubber, employing a radiant type heating element subject to visible indication of operation. It controls pumps and operates alarms. For copies of Bul. T-3 and T-4 address Automatic Control Company, 2590 University Ave., St. Paul, Minn.

"Motor Mounted Pumps—by DeLaval"—Is a presentation of specifications and an illustrated description of DeLaval Motor Mounted Pumps (single unit construction) in capacities of 5 to 1,200 g.p.m., against heads of 10 to 230 feet. Selection and installation of these "ready to go" centrifugals (with examples) are discussed. Dimensions and rating tables are also given. These compact units are available in various types of motors for the duty at hand. For a copy of "DeLaval Motor Mounted Pumps," address DeLaval Steam Turbine Co., Trenton, N. J.

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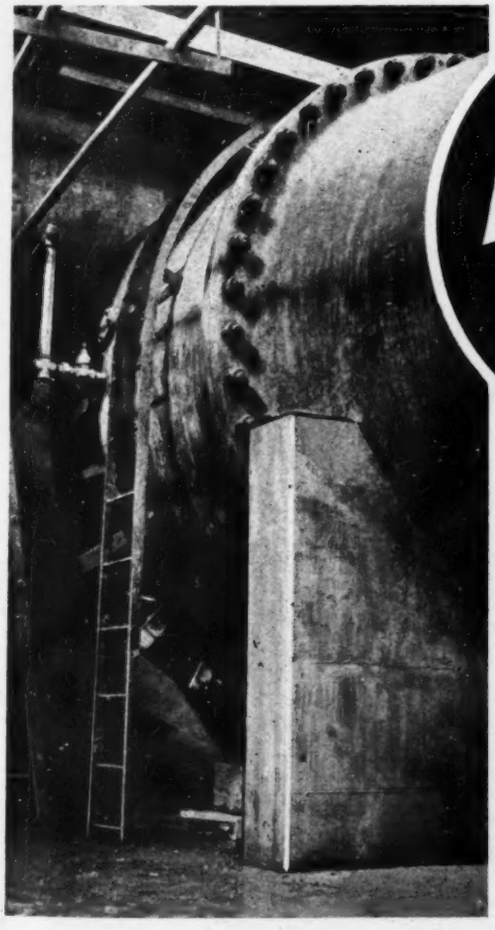

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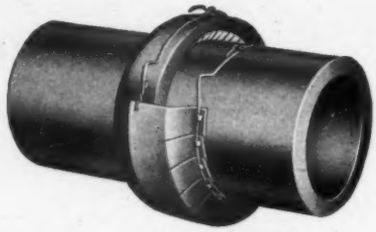

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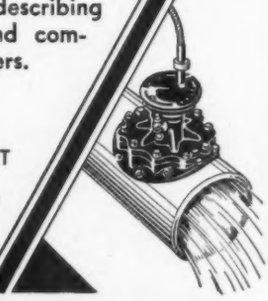

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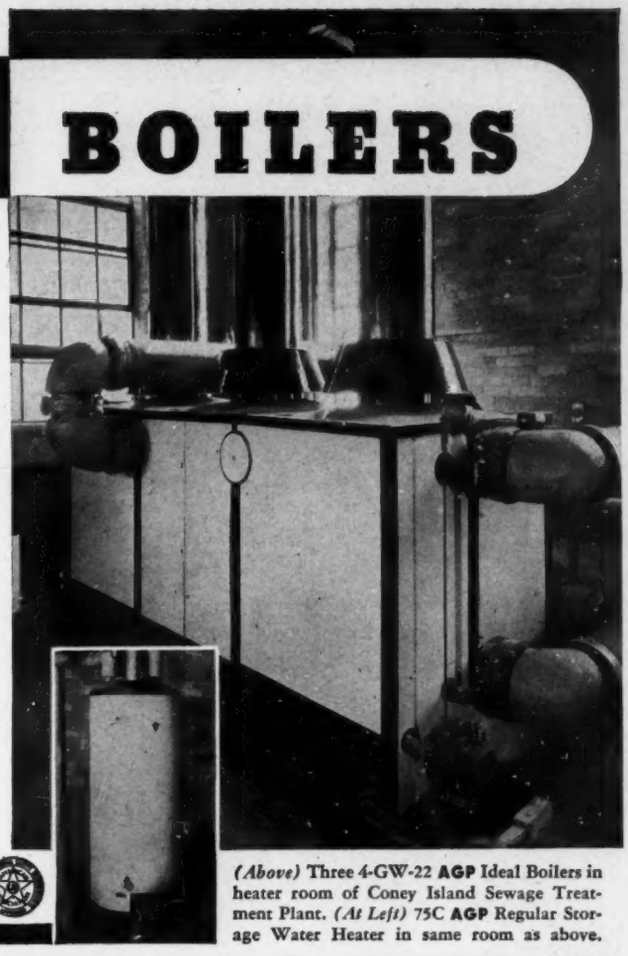

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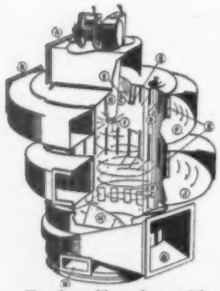

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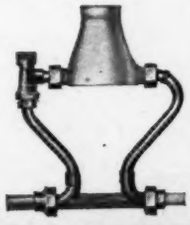

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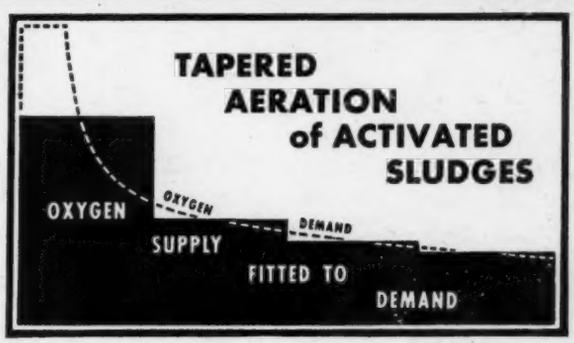

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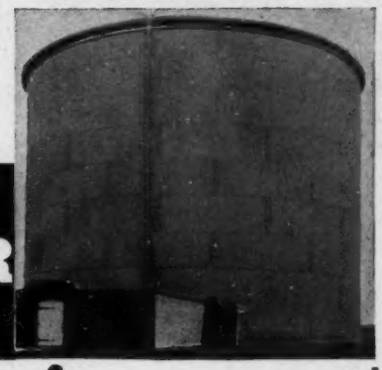

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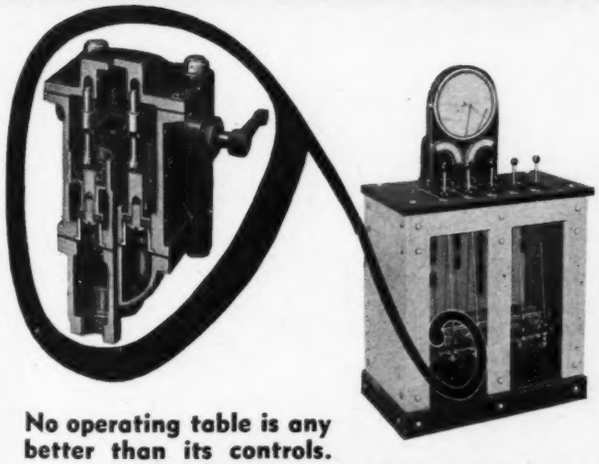

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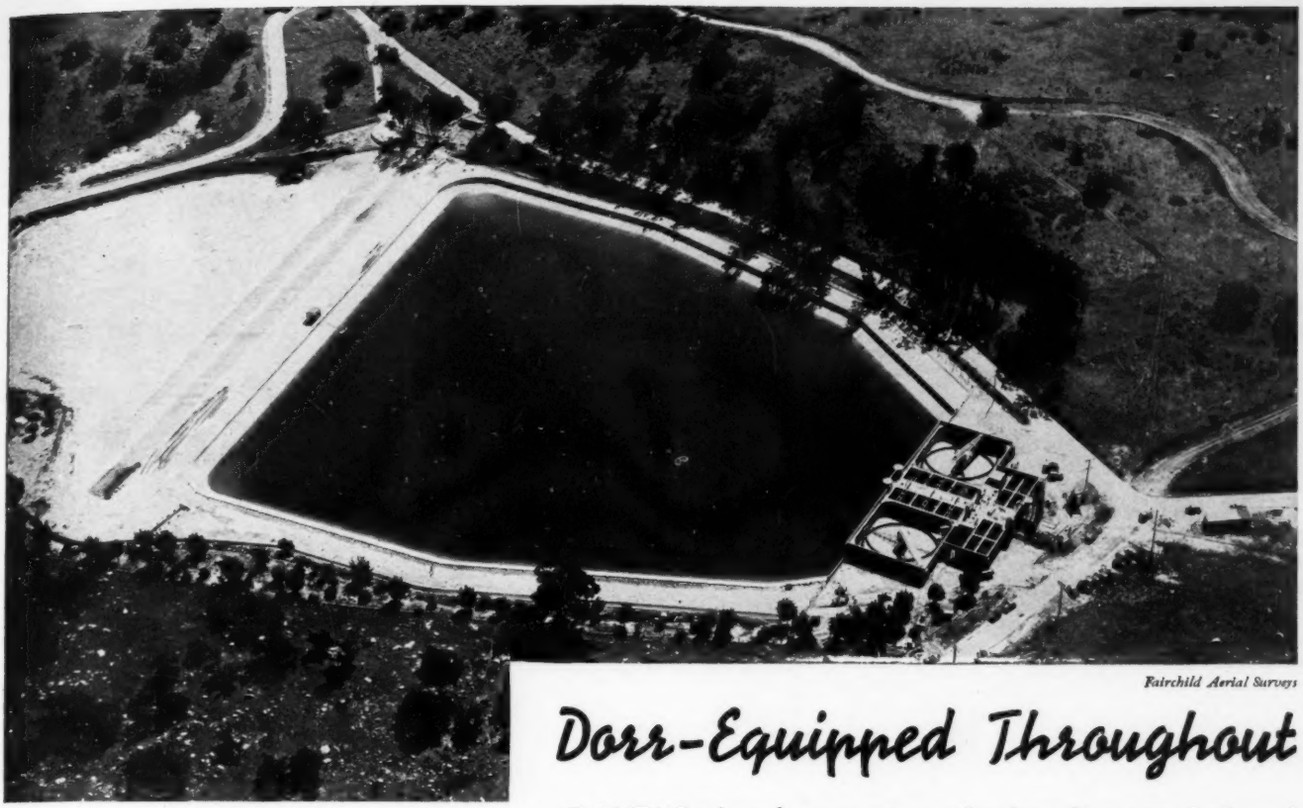

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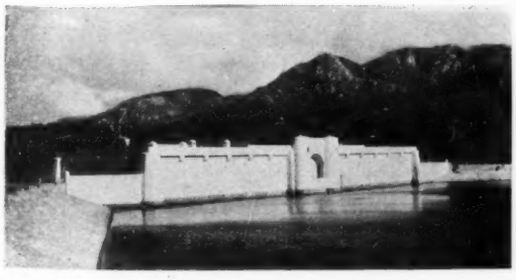

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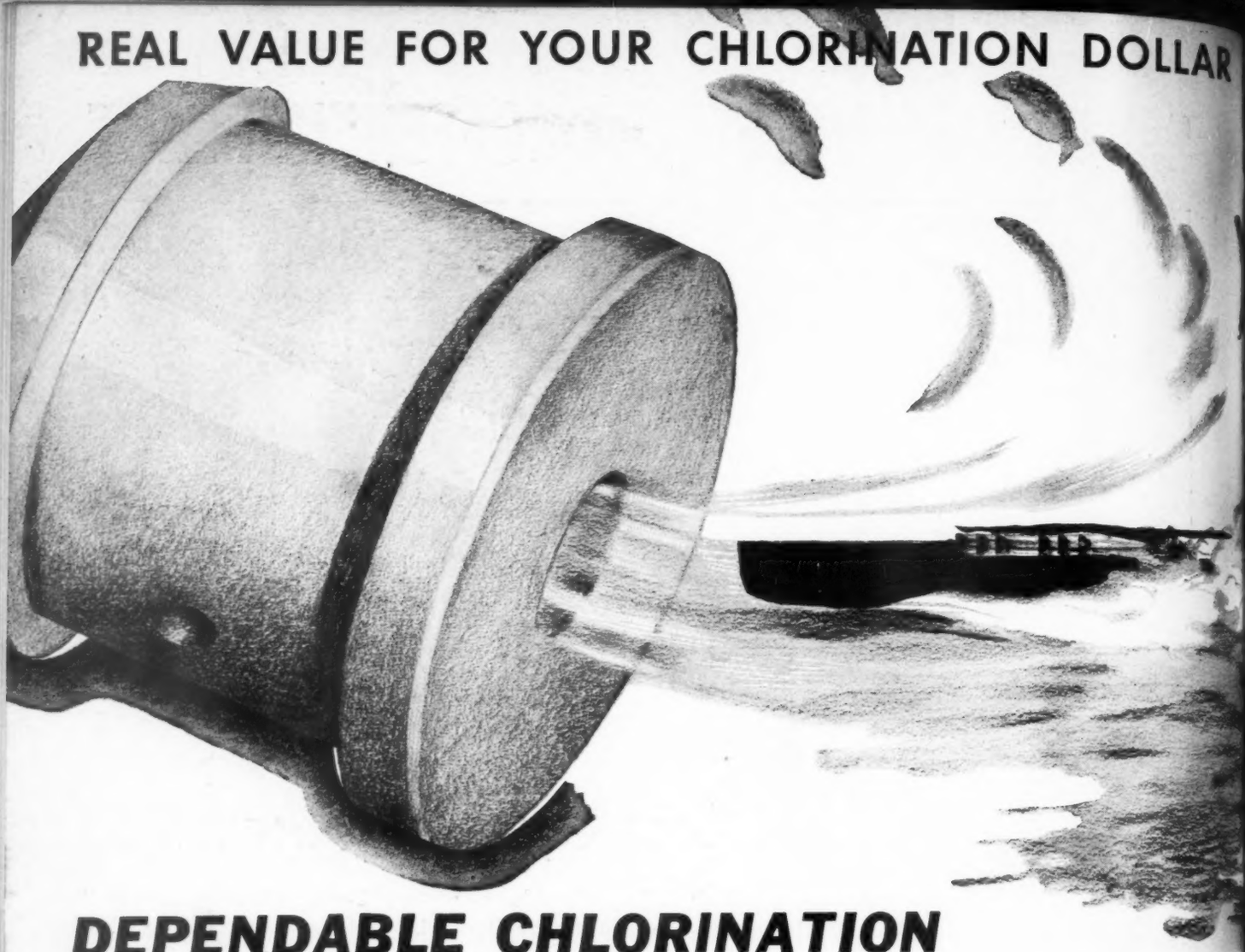

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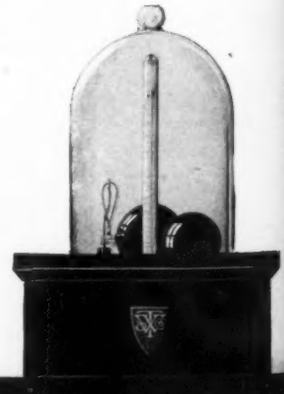

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